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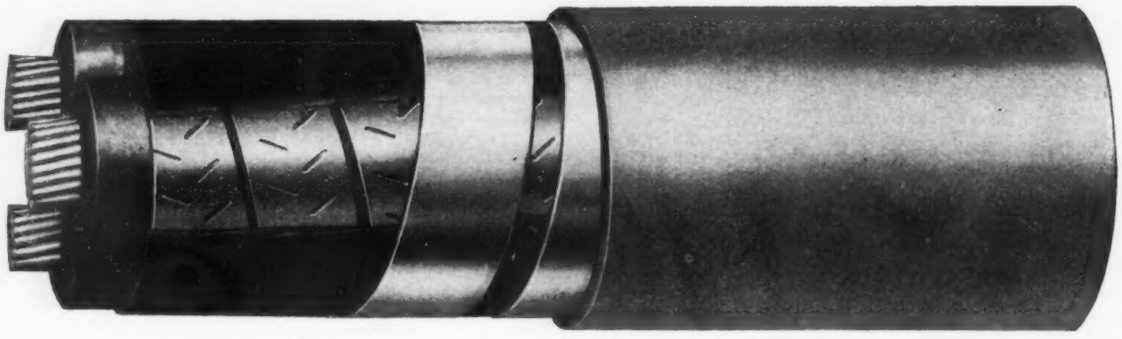
PERFORATED METAL TAPE

for Shielded Conductor Cables



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Governor Roosevelt's Quandary

POSSESSING water power and no coal, the sensible thing for any state to do would be to develop the water power. How to go about it, however, and still keep it in politics, is the question which perplexes the politicians. Water-power development is an economic and not a political issue, and, having in mind no doubt the experience of his predecessor during his many terms in office, Governor Franklin D. Roosevelt of New York approaches the issue somewhat more diplomatically.

It must be remembered that it was the Republicans, and not the Democrats, that carried the country in the last election, and that while a Democrat succeeded to the governorship of New York, the legislative branch is still, as it has been for many years, predominantly Republican. Therefore it can hardly be inferred that the attitude of the Democratic party of New York with reference to water power is to be followed. The Governor, however, is placed in a difficult position, for either he must break with the party platform or forego water-power development, since the legislative branch seems in no mood to accept government ownership. However, a wise statesman will do what is best for the state, and it should be obvious that New York must put its millions of undeveloped water horsepower to work and save by so much the importation of coal. It is lamentable that, because of a stubborn Legislature and an equally determined Governor, so little has been done to develop New York's natural heritage.

* * * *

Electrically Heated Homes

HEATING homes by the use of electricity has never been considered an economical procedure. The many energy transfers, from coal to steam to electricity, as compared with direct coal burning in house furnaces or with the use of gas, offer economic and thermal handicaps to the electrical system. But conditions change, and recent developments indicate the need of a serious study of the commercial possibilities involved in electrically heated homes.

The article by E. B. Dawson and J. F. Lamb contains experimental data that lead to interesting speculations. Ordinary homes for small families will use about 50,000 kilowatt-hours per year in the Pittsburgh area. But when the walls of the houses are insulated the consumption is reduced to about 30,000 kilowatt-hours per year or less and this energy, sold at about one cent per kilowatt-hour, does not set up much of an economic handicap to the use of electric heat. If convenience, comfort, control and other elements be measured in terms of sales, there is no doubt that many home owners would consider electrically heated houses favorably.

If off-peak energy can be used in conjunction with some house storage-heat system, possibly in conjunction with radiant heaters, a splendid new business for utilities may be developed. The architectural design of homes can be changed to embody the devices for electrical heating readily, and there is no doubt that many home owners would be willing to pay for such a service because of its many good qualities. The studies in Pittsburgh and others at Fort Wayne will enable the industry to measure possibilities quite accurately. Enough evidence is available now to show that electrically heated homes are worth-while new-business opportunities. The future may hold still better promise.

* * * *

Coal Distillation at Central Stations

POSSIBILITIES of low-temperature carbonization of coal have received much publicity of late and some visionary prospects have been pictured in our daily press. When one examines this development closely, it will be found that it is best described as:

> The phantom with the beckoning hand
> That still allures but still eludes.

The theoretical possibilities are most attractive. A very large number of processes have been proposed and tried, each with some features of merit. While certain of these methods have been so promising that they have been developed on a semi-commercial scale, none has definitely proved its commercial suitability as an adjunct to an electrical central station, and each trial installation is still a venture.

As a matter of conservation, it has always seemed improper to use coal as a fuel for the generation of power without first removing by some distillation process its more valuable contents of gas and tars. Low-temperature carbonization appeals to the power engineer as a possible treatment of coal in connection with central stations, and he has given sympathetic consideration to the various systems that have been evolved.

Many of these processes, of which some have been quite fully developed, aim to produce a smokeless fuel that can be used as a substitute for anthracite. The by-products of these processes have too high a form value to be burned under boilers. The only products from them that could be used in central stations might be small sizes of the char and some gas. A representative of such processes is that under development at the Philo (Ohio) plant of the American Gas & Electric Company. In general, however, such processes offer little hope of developing into means for reducing to any great extent the cost of central-station power.

Other processes are those in which the coal is distilled

to remove volatile byproducts before use as a fuel for power development. The byproducts are expected not only to pay all charges on the process but also to reduce the net cost of fuel supplied to the boilers. These processes appeal particularly to the central-station operator, and such plants as those employing the McEwen-Runge process at Lakeside station, Milwaukee, and the Babcock & Wilcox process at Dunstan station, England, are being watched closely by engineers. The latter alone has passed the development stage, and it still has to be proved with other than English coals. Progress with these and several other less fully developed processes has encouraged many engineers to become enthusiastic over the possibilities of their utilization in power plants. Incidentally, the greatest gains will be possible with the lowest-priced coals, for the savings from the byproducts will provide relatively the largest gains in reduction of fuel cost. Processes for hydrogeneration and liquefaction of coal appear to have no connection with central-station operation, but may serve as industrial power users.

Substantial progress has been made in the development of many distillation processes. Interest of engineers is still maintained in their possibilities. However, a conservative review of their present status indicates that the commercial employment of low-temperature carbonization in central stations has not been fully vindicated under American conditions.

* * * *

A Municipal Plant Short of Water

WHAT would happen to a municipal system, or any private system for that matter, with only one hydro-electric plant and virtually no water to operate it? That is exactly the position the city of San Francisco would find itself in if it now had a loaded municipal distribution system. Cold weather and lack of rainfall in the Hetch Hetchy watershed have caused depletion of the O'Shaughnessy reservoir and the 80,000-kva. city-owned Moccasin plant is almost entirely dependent upon stream flow. The output has thus been reduced to a few thousand kilowatts, and there is no immediate relief in sight.

The Pacific Gas & Electric Company contracted in 1925 to take the entire output of the plant pending decision of the city as to ultimate disposal of the power. Up to January 1, 1929, this contract has netted the city $7,720,000, or nearly enough to pay the interest charges on the entire bond issue of $45,000,000 for the combined domestic water supply and power project. Fortunately, the Pacific Gas & Electric Company, with its great interconnected system and its many steam and hydro plants, is able to tide over the embarrassing situation created by the rather sudden loss of a large part of the plant's generating capacity. Through the city's co-operation the company is able to utilize the plant for peak loads and thus still derive some benefit from it.

No particular blame attaches to San Francisco. The plant has been well operated under the city engineer's department. The situation merely emphasizes the necessity that large interconnected systems with hydro-electric plants shall have a diversified water supply and the further necessity of steam reserve to back up the whole. Any municipality contemplating going into the light and power business would do well, in the light of these facts, to consider all costs and angles of the undertaking before wading into shallow water.

* * * *

Research as a Business Help

RESEARCH is no longer considered a business philanthropy. It is no longer a side issue or hobby to be supported or neglected in the degree that money is donated by its friends. On the contrary, as recently stated by Irving Langmuir: "The leaders of industries are frequently conscious of the need of improvement in their processes and even of the need of new discoveries or inventions to extend their activities." Research is the modern tool by which to work out commercial success in any industry.

But beyond the commercial incentive to survive under highly competitive conditions there are broader aspects of research that affect business directly. Heretofore the world has been built and operated largely through the wasteful use of raw natural resources. Many of these have now been reduced in volume, but, despite this, man-made products derived from researches have supplied the public demand with cheaper and better products than those made from the original materials. For example, cheap lumber for building is a thing of the past, but cement, steel and special building materials have replaced lumber, and construction methods have changed, so that buildings today are better and cheaper than those made from raw lumber.

Under the spur of a diminished supply, research comes into being to replace old materials with new, and business today realizes that only through scientific research can it remain prosperous under modern conditions. No organization economies can replace research as a direct method for maintaining business success.

* * * *

Poor Tools for Good Workmen

WHILE illuminating engineers have learned much about the physiological factors of their art, have investigated intensities, glare, distribution and backgrounds and have obtained lamps of excellent light characteristics, the fixtures in which they are placed are in general an abomination passing all understanding. The modern note is being stifled to attain uniformity; the best of the old is neglected.

One glance at a catalog of current offerings of home-lighting devices is sufficient to prove the point, for here are imitations of oil lamps set in an annulus of thin-rolled brass; horrible contortions of glass, a material which may be made incomparably lovely; dust catchers, eyesores, painted atrocities and hopeless relics of precedent. Electric light is as much a part of the modern home as the walls, doors, floors and windows. It is not something to be supplied by sticking a shining brass creation of glass and lamps in the middle of the room or on the walls like a picture.

Light should be built in. It should be supplied from invisible or unobtrusive sources. It should be a part of the design of the room. Decorative lighting, whether of floor or table lamps or ornamental figures, should be supplementary. This is a plea for the intelligent application of the knowledge at hand, waiting to be used, and of the facilities readily available. If the original Wright machine were used in air-mail service today, it would be

no less ridiculous than is the manufacture of lighting fixtures, particularly home devices, blindly supplying gewgaws that were, esthetically, none too satisfactory yesterday. Almost any new house or apartment is a horrible example of the things which may be done in meeting the builder's ideas of what is good enough.

* * * *

Spare the Meter and Spoil the Data

INADEQUATE metering of subdivided electric service is a major obstacle to complete analysis of industrial operations in too many plants utilizing energy from power companies. Bulk delivery of energy to the customer's buses is properly measured almost without exception, but in many cases the internal plant accounting for such energy leaves much to be desired. Years ago a good deal was said in engineering circles about the importance of measuring departmental energy consumption and demands, and today a fairly broad separation exists between light and power service from the internal metering viewpoint. The installation of recording instruments on the interior circuits of industrial establishments has made considerable headway, and the interpretation of such information as these instruments provide along routine lines is generally admitted to be helpful in gaging the continuous efficiency of motor drives and heating applications. There is a considerable gap, however, in many organizations, between metering at the source of plant energy distribution and check-ups giving data on the energy requirements and demands associated with unit production of commodities under stated volumes of factory output.

Power companies and their industrial customers are mutually interested in the application of efficient electrical service to production. A study of the metering situation inside the plant should form a regular and routine suggestion in the intercourse between power sales engineers and purchasers of energy, and not be left to the initiative of the plant owner. It is important to find out in every case whether special instrumentation is warranted inside a plant and, if so, where and at whose cost. The need of permanent or temporary installations should be looked into, and the limitations of tests of electrical requirements set against various production conditions determined. In single-product plants turning out a mass of uniform material or commodities, like standard breakfast foods or bulk chemical items, it may be sufficient to rely upon input meters in the industrial substation or at the utility end of a special feeder to provide the required check of conditions; but even here categorical assumptions are unsafe.

The power engineer is generally in a position to offer very useful advice to his customers in this field, and his familiarity with processes trains him to appreciate just what returns localized metering is likely to yield particular industries. The desired results may be attained in one case by the use of instruments loaned or rented for a period by the power company to the customer, or in another by a carefully planned investment in metering apparatus by the customer or his consulting engineer. At present the scope of industrial localized metering is too often left to chance or else its value is not brought home to the customer in a way to insure constructive action. Improvement is to be found along the line of co-ordinated effort by the parties in interest.

When the Farmer Comes Into the Market

MANY eyes in the electrical industry are looking toward the farm market. There are roughly six and a half million farms in the country. About half a million are now connected to power lines. On every one of the other six million there is also a family, living isolated from the conveniences of town and deserving all the labor-saving and comfort appliances that modern electric service offers. In addition the farmer needs electric power in his business, for lighting his barns and poultry houses, for pumping water and driving small machinery and perhaps for milking. It offers him economies in labor that will vitally increase his earnings and his peace of mind. Ultimately several million of these farms will be substantial users of electricity.

The question at the moment is largely one of dollars. The farmer is not only interested, but he is actively demanding power. Good roads, rural mail delivery, the motor car and radio have brought him into close touch with town. He and his family have developed an eager appetite for these good things of life. The problem now is to make it possible for him to acquire them as other men do.

Fundamentally, it is not a question of the farmer's ability to buy. About five million passenger automobiles are in use today on the farms of the United States. This does not include trucks. These motor cars which the farmer is using for his convenience and the enjoyment of his family easily represent an average investment of five hundred dollars each. In other words, somewhere around two and a half billion dollars have been invested by agricultural America in the comfort and utility of modern transportation. These are large and impressive figures. They offer convincing evidence that the farmer can purchase what he determines to be necessary.

It costs in the neighborhood of three thousand dollars for a farmer to install the equipment he requires to enjoy the full benefits of electricity in his house and barns. That is considerable cash. But the experience which the farmer has had in acquiring his binders, mowers and other machinery, his motor cars and wagons, his live stock and his buildings has accustomed him to the spending of substantial sums. Though he is a conservative, he is not afraid to buy. Because his income follows the harvest and his cash comes once or several times a year and not in regular monthly revenues, he is in the habit of buying on the installment plan or by borrowing. The success of the automobile industry in selling to the farmer has been in no small degree because its terms have been adapted to this situation. And the electrical industry must meet the very same condition.

The job is not primarily to make the farmer want electricity, but to help him to buy. The financing of line extensions should be done at the bank. The farmer's money should be devoted to the purchase of equipment that will give him the services he wants and by building up a load make him a profitable customer. His installation of wiring, lighting and appliances should be sold to him not piecemeal but as a complete equipment financed on a basis that he can assume. When this is done the farmer will come into the market and the electrical industry will enjoy one of its most prosperous periods of expansion.

Floodlighting Historical Buildings in Prague

DURING the tenth anniversary of the Czechoslovakian Republic, just recently past, the historical buildings as well as monuments in Prague were floodlighted through the co-operation of the architects and the Prague Electrical Enterprises' power distribution department. The effect was so attractive that the essential part of this illumination will be retained permanently. For this purpose 600 kw. had to be supplied.

Among the structures illuminated were St. Charles Bridge, built in 14 A.D.; Church of Our Lady, completed in 1511; St. Nicholas Church (17 A.D.), Castle of Prague (9 A.D.), Powder Tower (15 A.D.), Wilson's statue, Old Town Hall (1338), and the National Museum.

Church of Our Lady

St. Charles Bridge, with National Theater in right background

Standardizing
Automatic Substation Designs

Advantages of unit or block system in providing for future development. Features of construction and control adopted

By William W. Edson

Station Engineering Department,
Edison Electric Illuminating Company of Boston

IN RECENT years much work has been done by manufacturers in standardizing electrical apparatus and by operating companies in the standardization of general station assemblies and policies. The rapid growth and expansion of electrical distribution and the tendency toward numerous relatively small alternating-current substations located at the various individual load centers necessitate a still further standardization of design and construction.

Advantages of Standardized Substations.—The advantages of a uniform station design are:

1. The preliminary considerations, such as load studies, cost estimates, land requirements, etc., are simplified, similar information of duplicate stations being at hand.

2. The purchase of the apparatus is simplified and the price and delivery are improved, since these orders are duplicates of previous ones, requiring in many instances no preliminary quotations or special developments. The advantage of quantity purchase is also obtained.

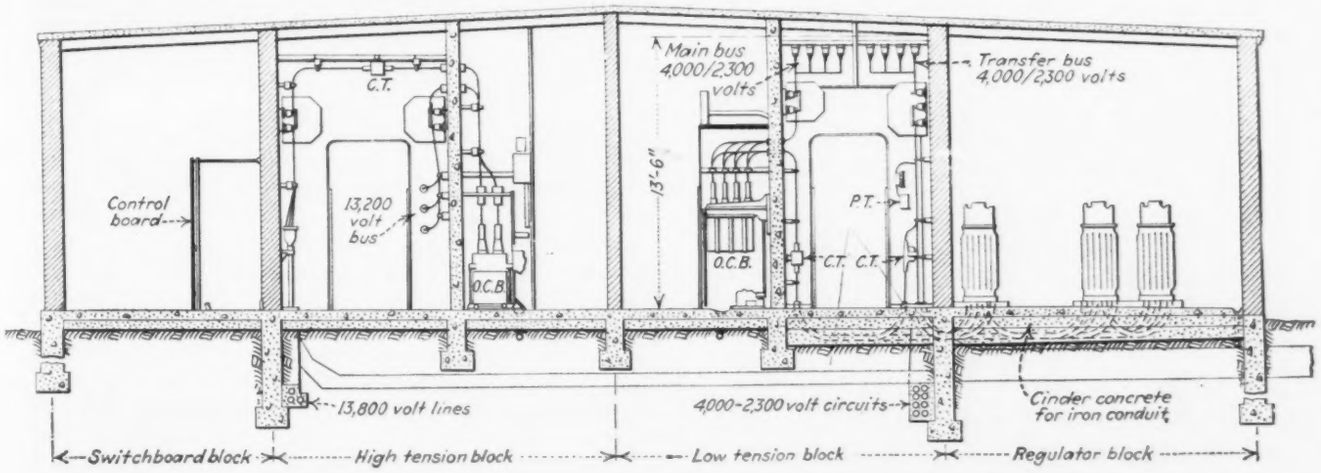
3. The work in the design and in the drafting room is lessened, only minor changes (mostly in assembly) from the previous station drawings being necessary.

4. The time and cost of installation and testing are reduced, troubles having been eliminated by previous experience.

5. Operation and inspection are simplified, the apparatus and connections being the same in all stations. This also facilitates the instruction of new men.

6. It is known in advance that the completed station and its operation will be satisfactory to the various departments concerned, the individual standards having already been approved.

The System Defined.—The system of construction developed by the Edison Electric Illuminating Company of Boston, wherein the above benefits are realized, has the following features:



Needham substation is representative of the unit or block design

1. Subdivision of the entire substation into independent standardized "blocks" classified in accordance with a definite scheme of segregation based on experience.

2. Simultaneous development of building and its contents.

3. A new simplified system of multi-transformer control based on load.

4. Engineering procedure in accordance with approved schedules of material and construction.

A Typical Substation.—A typical automatic transformer station at Needham consists essentially of two transformers stepping down from a 13,200-volt bus to 4,000/2,300-volt, four-wire ungrounded neutral main and transfer buses, all three buses having sectionalizing circuit breakers or disconnecting switches between the transformer sections. The basic feature which permits the standardization of construction is that the station is divided into blocks, complete in themselves, and suitable for being arranged or added as desired.

For each transformer section there are four blocks:

1. A high-tension block for two incoming 13,200-volt lines, the high-tension side of the transformer, the cir-

cuit for the constant current lighting transformers and the bus sectionalizing breaker.

2. A low-tension block for the low-tension side of the transformer, four 4,000/2,300-volt feeders and the bus sectionalizing breaker and disconnecting switches.

3. A regulator block for the feeder induction regulators. The battery charging motor-generator set and the station power and lighting transformers are located in the space opposite the low-tension bus tie cell.

4. A switchboard block for the control switchboard, constant current lighting transformers, battery room and toilet.

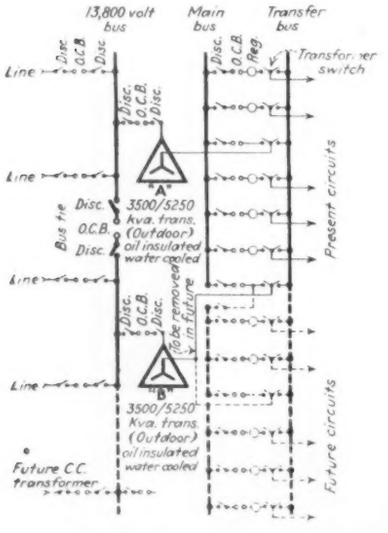
Advantages of the Block Design.—

1. Complete segregation, the blocks themselves forming natural fireproof subdivisions.

2. Flexibility in arrangement to meet land or neighborhood conditions; thus the switchboard block may be located in front or at the side of the building, the switchboard and regulator blocks may be located above the high- and low-tension blocks, and additional blocks may be extended in any direction.

3. Efficient provision for the growth of the station by the addition of the necessary blocks only as needed. The benefit of this feature is particularly important for a new station having initially only a few feeders but requiring two transformers for flexibility and reliability of operation. Only one low-tension block and one regulator block need be installed, the low-tension bus tie cell being used temporarily for the low-tension equipment of the second transformer.

4. Ease of modifying the design to meet special conditions. For example, if no street-lighting transformers and their control are expected, the switchboard room may be narrowed accordingly, and for stations of larger capacity the low-tension blocks may be arranged for an increased number of circuits.



Single-line diagram of Arlington substation

Miscellaneous Construction Features.—Each high- and low-tension block is divided by an 8-in. concrete fireproof wall so that the oil circuit breakers are in one compartment and the bus disconnecting switches and instrument transformers are in the other. Metal lath and plaster 2-in. cell walls separate the equipment per circuit. The regulator room and circuit breaker cells are drained so that the burning oil of an explosion or fire would not spread.

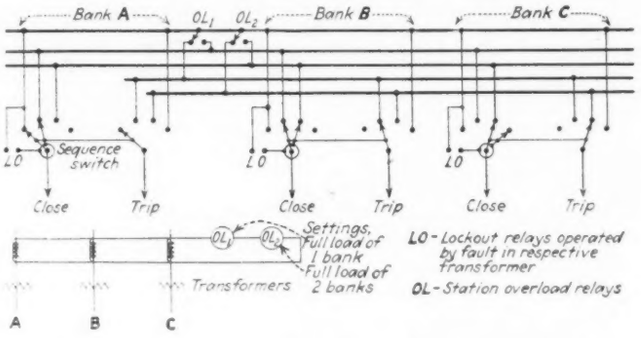
There is no reinforcement or other steel work carried over between cells. Even the iron conduit has an insulated joint before entering a cell. The ground buses are run on insulators to prevent faulty currents passing through the structure.

Exposed flameproof varnished-cambric cable is used for the main connections. The high- and low-tension cables running to the outdoor transformers have oil-filled potheads to prevent leakage of oil from the transformers, which are of the "industrial" oil pothead entrance type. This latter construction eliminates all outdoor structure.

An individual ventilating fan is provided for each compartment so that any room can be quickly cleared of smoke or gases after a fire.

Individual automatic electric heating units and circulating fans are installed in each room for general heating and to prevent condensation.

The general illumination is by alternating current, but floodlights and certain lighting circuits are on a manually operated change-over switch to the battery for emergency use.



Schematic diagram showing automatic control

Automatic Control for Transformers.—Parallel with this development of the block system, a new method of automatic control of such a station has been devised. The following features, which are of particular interest, are not only new in method of operation but are also especially applicable to the above type of station construction:

1. *Flexibility.*—As the control equipment for each bank is self-contained, transformers may be added, removed or changed, equipment may be inspected or tested and operating values varied without affecting the normal automatic operation of the rest of the station.

2. *Control.*—Current control is provided to switch in or out added banks as required to meet the total station load and to give the highest over-all station efficiency. This latter condition is met by setting the cut-in relays at a point where the core and copper losses of one transformer equal the total losses of two transformers. Expressed mathematically, the most efficient point to cut in a second bank equals $\sqrt{\frac{2I}{C}}$ where I is the core or zero load losses of one transformer and C is its full load copper losses. This point averages approximately 90 per cent of the nominal rating for the transformers used.

Special Transformer Design

Closely associated with this scheme of operation is the special design of transformers developed for the Edison company. As the normal operation may be expected to be near 75 per cent load, the transformers are ordered to have their most efficient operation at this point. The transformers are so selected for a three-unit station that their total full load capacity equals the maximum station load. These transformers, however, have sufficient copper and cooling surface to allow a 50 per cent overload to be carried continuously without overheating. Therefore, one bank may be out of service without affecting the total station capacity. As this overload operation is only

an emergency condition, the efficiency at this 150 per cent rating is not especially important. Therefore, the transformer cost is kept down. Such an installation allows the transformers to be safely loaded up to their efficient ratings without necessitating a normally idle spare transformer with its oil circuit breakers and control equipment.

3. *Full Selectivity.*—Each transformer has its sequence switch so that it may be made the first, leading; second, follow-up; third, alternate; fourth, out. Manual control switches are unnecessary. Transformers may be set up to operate in parallel as a group if desired, thus reducing the number of operating cycles or permitting two smaller banks to operate as a unit.

4. *Safety.*—Each transformer has differential protection, excess overload relays, maximum temperature relays, and has an over-all checking relay to insure that circuit breakers do not drop open or pump. Any of these faults will lock out the transformer and will bring in the following bank after a 30-second interval, which allows any synchronous load to drop out before the lines are reenergized.

There are several inherent features of design which promote safety to the equipment, such as the impossibility of harm due to improper operating of the sequence switches; only one polarity is taken to the circuit-breaker auxiliary switches and to the relay contacts; all relay coils are specified for continuous duty, and no relay contacts can be subjected to unsafe carrying or breaking currents.

5. *Reduction in Apparatus.*—The equipment has fewer relays than other designs hitherto employed. In fact, only the current-control relays are directly chargeable to automatic control.

Miscellaneous Automatic Control Features.—The manufacturer's method of automatically reclosing feeder circuit breakers has been revised to include the safety features and simplicity referred to above.

The battery charging motor-generator normally floats on the control battery, but will shut down in case of certain faults and will restart when conditions become normal.

A signal is sent over leased telephone wires to the nearest manually controlled station to indicate the opening of any line or feeder circuit breaker, the lockout of any transformer, or a ground on the 4,000-volt system. This latter indication is accomplished by means of a voltage relay connected between the system neutral and ground.

Itemized Lists of Equipment.—An itemized bill of material is an essential adjunct to the standardization of substation design. This list is grouped in accordance with the station blocks and gives such information as may be needed during the various stages of engineering and construction.

After the capacity of the station is decided upon, it is very simple to make a selection of apparatus by specifying the number and kinds of blocks desired.

The estimate for the expected equipment and installation cost of the station is taken directly from the itemized and total costs in the table.

The ordering of the material is expedited, as the information includes for each item the number or amount, manufacturer, size or rating, style or specification number, and reference to previous orders.

TABLE I—ITEMIZED LIST OF EQUIPMENT—SAMPLE SHEET

High-Tension Block	Spec.	Previous Order	Standard Diagram	Index	Cost
2—Lines (250-amp. capacity)	.....	..	.....	...	..
1—Oil circuit breaker, type *, 600 amp., 15 kv., with * contactor, four-stage auxiliary switch, 350,000-cm. lugs	8404A	*	07298	101	*
3—Disconnects, etc.	.....	..	.....	...	..

*Indicates manufacturer or type; omitted here for obvious reasons.

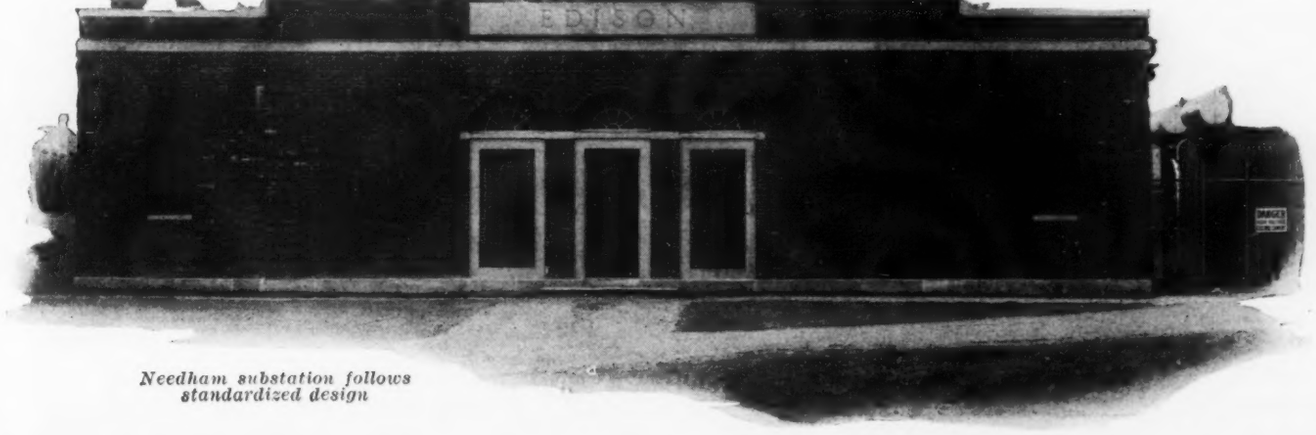
Any item which may vary due to size of transformer is underlined, and reference is made to a summary sheet which gives this information for the different sizes.

The engineering and drafting are materially aided, as these consist essentially of assembling the standard unit and block drawings and diagrams.

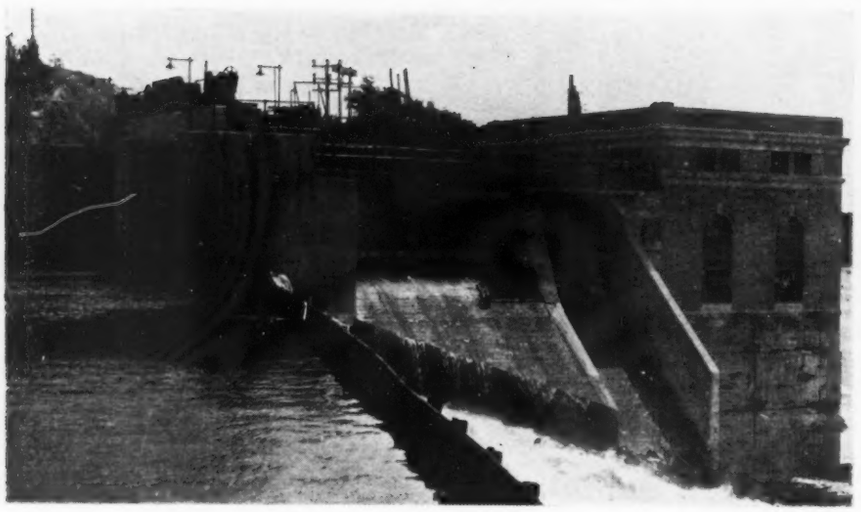
The installation is facilitated by the references to previous installation specifications and to any special features or details which should be considered.

The index column refers to a book of company standards which contains such information as complete and detailed specifications, or description of the various items, engineering data, special instructions or cautions, drafting room standards, etc.

These details of standardization have been satisfactorily applied to five such automatic substations and the advantages are quite apparent. There have been a few minor changes, mostly along the line of simplification, but in general these stations are all very similar. This over-all station standardization has been applied only to alternating-current stations, but it is expected that similar principles can be applied to the automatic direct-current stations.



Needham substation follows standardized design



Androscoggin No. 3 station, showing dam, tailrace and tower supporting generator leads and control cable

$106 per Kilowatt for Automatic Hydro Plant

By G. W. Maker
Morton C. Tuttle Company, Boston, Mass.

MORE than 41,000 hp. of hydro-electric power is developed within a mile on the Androscoggin River above Lewiston, Me., at the Deer Rips, Gulf Island and newly completed Androscoggin No. 3 stations of the Central Maine Power Company. The last-named plant develops only 3,600 kw., but is a valuable addition to the facilities of the company in this region because it enables the normal flow from Gulf Island in excess of the capacity of the wheels at Deer Rips to be utilized instead of wasted. Construction was begun on Androscoggin No. 3 in October, 1927, and the plant was placed in service last August. The average working force was 110 men and the cost of the job was about $380,000, of which labor represented $125,000.

The Gulf Island station has a rating of 27,000 hp. and the reservoir created by its dam has a useful storage of 500,000,000 cu.ft. of water in addition to the regular river flow. In considering plans to enable excess water above the capacity of the Deer Rips plant to be utilized as far as possible, it was found to be more economical to build a new generating station on the opposite side of the river from Deer Rips plant than to enlarge the Deer Rips intake canal and build an addition to that plant, with consequent interruption of service. The spur track which had served the Gulf Island construction was also available on the east side of the river.

In building the new station it was necessary to excavate an intake channel in ledge to a maximum depth of 20 ft., a width of 40 ft. and a length of about 100 ft., with a tailrace about 400 ft. long. The November, 1927, flood and the freshets of last spring caused no damage or delay in the work, and in each case the Gulf Island reservoir aided in reducing the peak flow. The operating head at Androscoggin No. 3 is 32 ft.

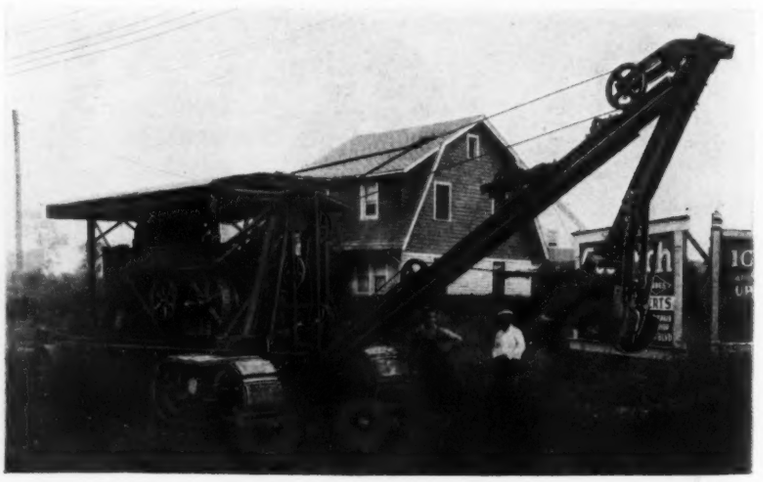
The plant contains a 3,600-kw., 11,000-volt General Electric generator vertically driven by a 5,500-hp. Allis-Chalmers high-speed turbine designed for 94 per cent efficiency and operating at 138.5 revolutions per minute. The unit is controlled from Deer Rips by General Electric remote-control apparatus and the automatic features include protection against overload, overvoltage, overspeed, loss of field excitation, overheated windings and short circuits. The unit is started up, wheel gates opened, speed attained, synchronization effected and the desired load assigned by the operators across the river. Control equipment includes motor-operated windows in the generating room.

The construction was done under the supervision of the Morton C. Tuttle Company, the designs being prepared and the work done under the direction of the engineering department of the New England Public Service Company, Augusta, Me., F. H. Mason chief engineer. F. W. Harris was resident engineer for the Central Maine Power Company.

Trenching, Backfilling and Loading with One Machine

By Theodore R. Eilenberg
Structural Engineer
New York & Queens Electric Light & Power Company

ON A street recently widened but not paved, containing very few services and out of traffic, a Keystone digger was recently used very successfully by the New York & Queens Electric Light & Power Company for preparing a trench for a conduit system. On the average this digger excavated 400 linear feet a day, to a width of 2 ft. 6 in. and an average depth of 6 ft. Approximately 200 cu.yd. of earth was removed per day. It was also possible to use this machine for backfilling the trench and loading the truck by changing the bucket. When used for backfilling this machine restored as much as 100 cu.yd. of material in the same day.



Trenching machine backfills and loads in installation of conduit system

Electrically Heated Houses

Complete tests on insulated and uninsulated homes. Types of heating systems and controls. Load characteristics of house heating. Business possibilities indicated

By E. B. DAWSON and J. F. LAMB

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

THE most convenient and flexible method of heating residences is by the use of electric heat. Electric heat can be generated in the rooms where it is needed, either by totally concealed convection heaters or by attractively designed radiant heaters. Automatic temperature control for individual rooms is easily obtained. This is especially desirable in apartments and in very large residences, where a central heating plant is often too inflexible for obtaining the desired temperature control in different portions of the building.

Practically no labor is required to operate an electric heating system. There is no coal to shovel or ashes to remove. Electric heat is inherently a clean heat and its widespread use would undoubtedly assist materially in minimizing the servant problem.

As electric heat does not require oxygen from the air or give off any obnoxious gases, it is also the most healthful of all the forms of heat which can be generated directly in the room. The radiant electric heater can therefore be applied where other types of radiant heaters would be objectionable.

The automatically controlled electric heating system works the entire year around with almost no attention. It operates with as much efficiency during weather which requires only the intermittent use of heat as it does during very cold weather. In fact, the most immediate field for electric heat would appear to be in some of the Southern and Southwestern states, where the heating system would operate more or less intermittently.

The only legitimate objection to residential electric heat from the standpoint of the user is the cost of the power required. It may be possible that at some future time, perhaps not far distant, this objection will no longer apply. Even at the present time there are quite a few houses in the Pacific Coast states heated entirely by electricity. There are also a few installations in the northern states, chiefly summer homes occupied from April or May until November. Electric heat, while admittedly a luxury at present, cannot be considered as being entirely out of reach of certain portions of the population.

The cost of electric heat has tended to prevent consideration being given to other sides of the question. In order to evaluate other factors in addition to the cost, the Westinghouse Electric & Manufacturing Company, in co-operation with the Duquesne Light Company and the Armstrong Cork & Insulation Company, conducted some tests on two six-room houses heated entirely by electricity. The houses were located at Forest Hills, Pa., which is several miles from Pittsburgh. For purposes of comparison, data were also obtained on a third house which was heated by a non-automatic coal-fired hot-air furnace. The three houses were essentially the same in construction and floor plan, the main difference being that one of the electrically heated houses was insulated with 1½ in. of corkboard in the walls and in the basement ceiling and with 2 in. of corkboard in the second floor ceiling. All three houses were equipped with storm windows on the first and second floors. The houses were occupied during the test period by two people in the cork-insulated house, by three people in the coal-fired house and by five people in the uninsulated electrically heated house.

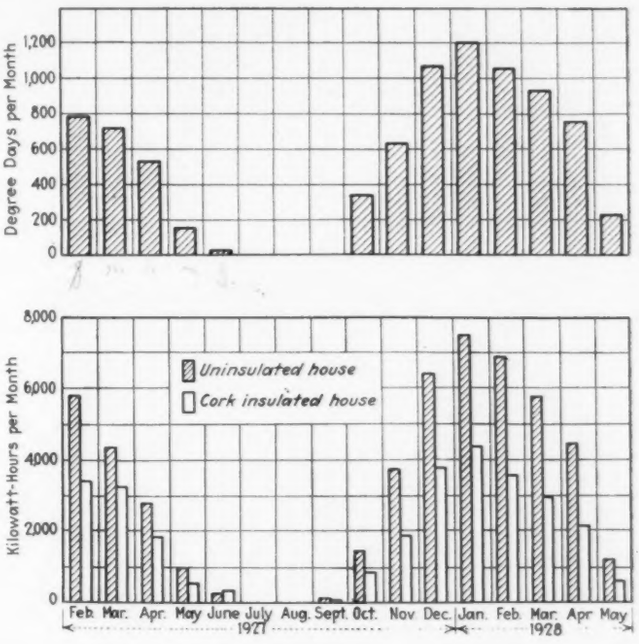


Fig. 1—Kilowatt-hour consumption and degree days by months

ENERGY REQUIREMENTS

The energy required for heating a given residence over a certain period is roughly proportional to the number of degree days in the period. A degree day is numerically equal to 1 deg. F. in outside temperature below 65 deg. F. over a period of 24 hours. It is chosen as a unit because experience has shown that when the mean daily outside temperature drops below 65 deg. F. heat will usually be required.

The degree days at Forest Hills as mentioned in this article were calculated by subtracting the average monthly temperatures below 65 deg. F. from 65 deg. F. and multiplying by the number of days in the month.

The kilowatt-hour consumption by months for the two electrically heated houses at East Pittsburgh is shown in Fig. 1. It can easily be seen from this curve that the power consumption during the heating season is depend-

ent upon the number of degree days. The curves show the difference in energy requirements between the uninsulated and the cork-insulated houses, the shaded rectangles indicating the consumption for the uninsulated house.

From Feb. 4, 1927, to May 31, 1928, the uninsulated house consumed 50,440 kw.-hr. for heating and the cork-insulated house 58 per cent as much, or 29,250 kw.-hr.

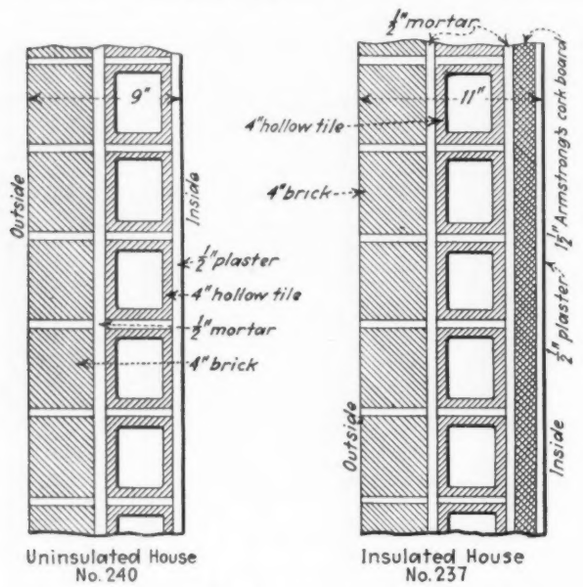


Fig. 2—Wall section of electrically heated houses

From May 31, 1927, to May 31, 1928, the uninsulated house consumed 37,270 kw.-hr. for heating and the cork-insulated house 55.4 per cent as much, or 20,650 kw.-hr. Both houses had all openings weather stripped and calked in addition to the storm sash during the winter of 1927-28. The uninsulated house used instantaneous heaters with automatic temperature control, while the cork-insulated house used storage heaters during most of the 1927-28 heating season.

The difference in the energy requirements for the two houses cannot be entirely attributed to the cork insulation. Other factors in the two houses were not absolutely identical. While some of these conditions favored the uninsulated house, most of them favored the cork-insulated house. Nevertheless, the difference in the energy consumption between the two houses was so great that most of the difference can only be attributed to the effect of the cork insulation.

Actual measurement showed that the heat conductivity of the walls of the uninsulated house was three times as great as for the walls of the cork-insulated house, for the wall sections shown in Fig. 2. Heat is, of course, lost in other ways than by direct conduction through the walls.

Assuming that the cork insulation would not materially affect the basement heating, the energy requirements for the basements of the two houses should be about the same if operating conditions were identical. The actual basement requirements for the above twelve-month period were approximately 5,660 kw.-hr. for the uninsulated house and 1,450 kw.-hr. for the cork-insulated house. Neglecting the basement consumptions, the first and second floors of the cork-insulated house used 60.7 per cent as much energy as the corresponding portions of the uninsulated house from May 31, 1927, to May 31, 1928.

It is estimated that during the period from May 31, 1927, to May 31, 1928, the cork-insulated house would probably have used from 60 to 70 per cent as much energy as the uninsulated house, including the basement, if all the operating conditions had been exactly the same.

These figures illustrate very well the value of heat insulation for electrically heated houses, especially in the colder climates.

The energy saved by the storm sash, weather stripping and calking cannot very well be evaluated from the available test readings. There is no doubt that appreciable energy savings can be made by these features.

Air Conditions Unchanged

The question may be asked as to the air conditions in the houses when insulation, weather stripping, calking and storm sash are used. A few air humidity measurements were taken in all three houses. There was no marked difference in the per cent relative humidity of the three houses, although the coal-fired house apparently was slightly drier than the two other houses. It was noticed that when the humidity was high in one house it was also high in the other houses, and when low in one house, it was also low in the other houses. Apparently the cork insulation, weather stripping and calking had very little effect on the relative humidities inside the houses in comparison with other factors.

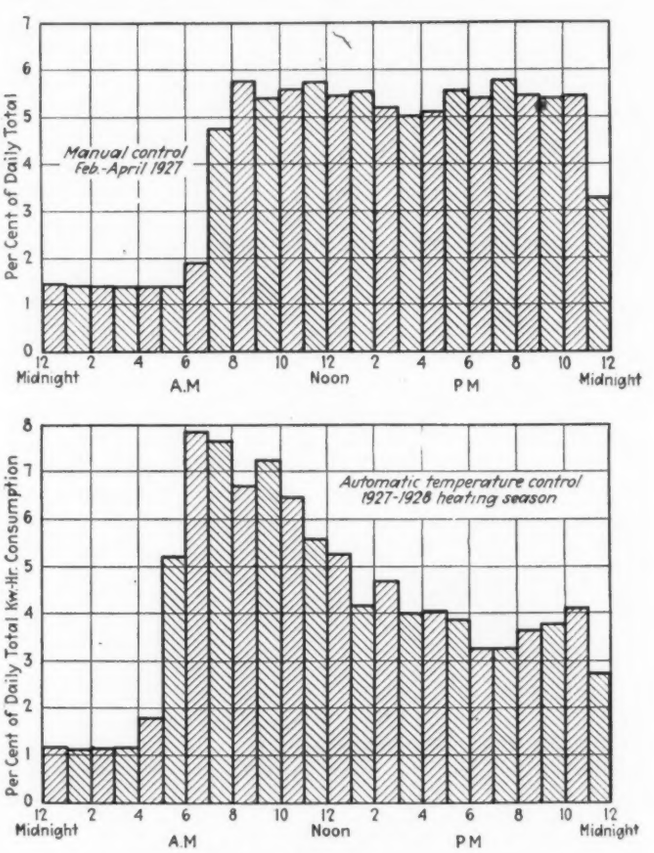


Fig. 3—Composite daily demand curves, uninsulated house

A few CO_2 measurements were made with a carbacidometer. Most of these readings showed the CO_2 content of the houses to be 0.8 part per 1,000 parts of air or less, and no reading exceeded 1.1 parts of CO_2 per 1,000 parts of air. This would indicate that the air conditions in the three houses were about on the border line between good and bad air. The uninsulated electrically heated

house apparently had a slightly greater CO_2 content than the other houses, probably because more people were living in this house.

It is the writer's opinion that neither the cork insulation nor the electric heating system had an appreciable effect upon the air conditions in the houses. The weather stripping, calking and storm sash had some effect, but just how much could not be determined definitely. None of the occupants in the houses complained of the air conditions. In fact, the people in the coal-fired house are seriously considering the installation of weather stripping at their own expense, in addition to the storm sash now in use.

The cork insulation assisted in cutting down the maximum kilowatt demands. This would ordinarily not cause much of a saving in the cost of the installed heater capacity, because there must be at least one heater in each room, even in the small rooms, and the heaters of large kilowatt capacity are usually not much more expensive than units of smaller kilowatt capacities.

Summing up the comparison between the two electrically heated houses, the tests indicated that if electric heat is used in cold climates, where the heating system must be used continuously, the house should be well insulated and should be made as tight as possible in order to reduce air infiltration. The colder the climate the greater is the amount of insulation which should be used.

Comparison with the Coal-Fired House

From Feb. 4, 1927, to May 14, 1928, the energy consumption in the uninsulated house was 52,545 kw.-hr. and in the cork-insulated house 30,400 kw.-hr. Over this period of time 26,000 lb. of coal was used in the coal-fired house.

The relative operating costs for the houses would, of course, depend upon the cost for electrical energy and the cost of coal, which varies for different localities.

There can be no fair comparison between the coal-fired house and the electrically heated houses. The coal-fired house was manually operated, while the electrically heated houses were using automatic temperature control much of the time. The extra convenience of the electric heat cannot well be expressed in terms of dollars and cents. In practically all comparisons between electrically heated houses and coal-fired houses the extra manual labor required to tend to the heating system is neglected, as is also the factor of relative cleanliness. The tests showed that the electric heat was much cleaner and more convenient than the coal-fired heat. The occupants of both electrically heated houses stated that they would be sorry to have to go back to coal-fired heat when the tests were discontinued.

Storage Type Air Heaters

Some interesting data were obtained as a result of using storage heaters in the cork-insulated house during most of the winter of 1927-28. The storage heaters consist of large metal containers filled with pea gravel. The walls of the containers have heat insulation. Heating elements are imbedded in the gravel. At night the power is turned on and the gravel is heated up to several hundred degrees Fahrenheit. In the morning the power is turned off and the heat stored in the gravel is allowed to escape into the room and warm up the house. Dampers or insulated doors are provided on the heaters to assist the heat to leave the heater.

These heaters were very successful in operation as far as using off-peak power was concerned. The storage heaters had been in service 163 days up to April 30, 1928, and during this period 31.5 per cent of the heat energy in the cork-insulated house was used from 6 a.m. to 9 p.m., while 68.5 per cent was used during the off-peak hours from 9 p.m. to 6 a.m.

During this same 163-day period the uninsulated house took 75.2 per cent of the energy from 6 a.m. to 9 p.m. and only 24.8 per cent of the energy during the off-peak hours between 9 p.m. and 6 a.m.

A complete account of the operation of these storage

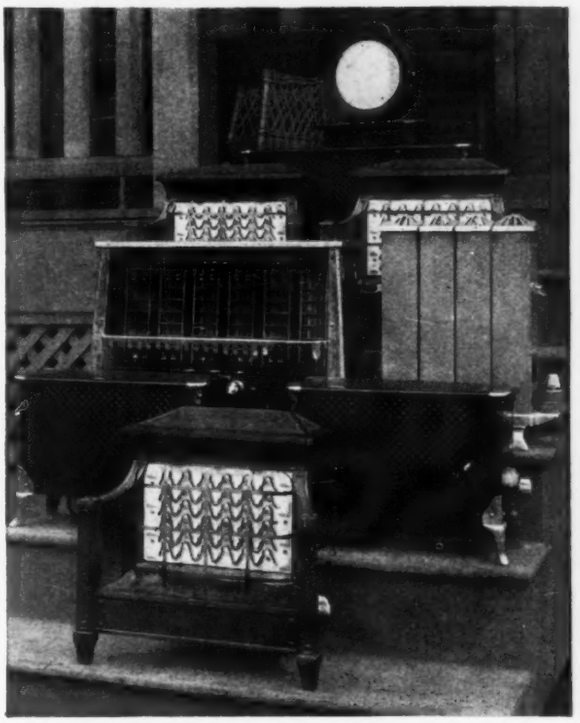


Fig. 4—Radiant and convection heaters used in the uninsulated house

heaters is given later in this article. The following conclusions were arrived at:

1. It is possible to use most of the energy required for heating a residence during off-peak hours if storage type heaters are used.

2. The storage heater is not suitable for warm climates or where a quick heat is needed during a small portion of the day. It can be used to good advantage in the colder climates, where the heating system would normally be in continuous use over long periods of time, providing power rates are favorable.

3. The best method of operation is to let the storage system carry the base-heating load and to have radiant or convection heaters take the peaks.

4. The present designs of storage heaters would have to be modified considerably if their use is ever to be widespread in the United States. They would not suit the present esthetic standards of the average American family. Additional insulation would improve the operating characteristics.

5. The great size and weight of the storage type of heater make them difficult to move and cumbersome to install.

6. The storage heaters are considerably higher in first cost than other types of heaters.

7. There is no way at present to control the storage form of heat automatically so that it will be as con-

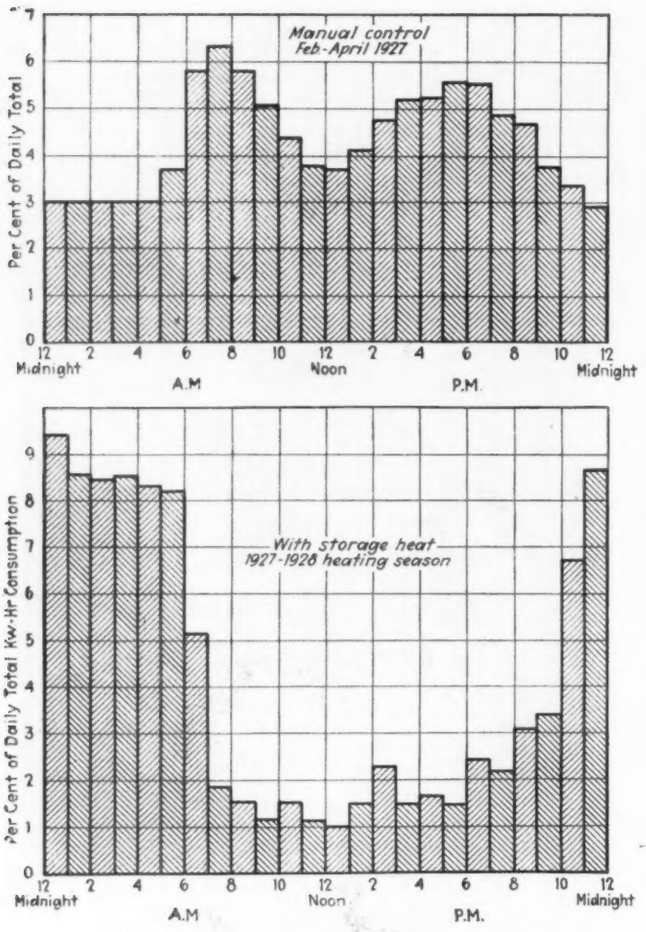

Manual control
Feb-April 1927
Per Cent of Daily Total
12 Midnight 2 4 6 8 10 12 Noon 2 4 6 8 10 12 Midnight
A.M
P.M.
With storage heat—
1927-1928 heating season
Per Cent of Daily Total Kw.-Hr Consumption
12 Midnight 2 4 6 8 10 12 Noon 2 4 6 8 10 12 Midnight
A.M
P.M.

Fig. 5—Composite daily demand curves, cork-insulated house

venient as instantaneous types of heaters with individual room thermostats.

8. The use of storage heaters is not justified unless the kilowatt-hour consumption is large and the off-peak power rates are much lower than the regular charges.

Demand meters were in use in each house to record the kilowatt demand throughout the day. Using the data obtained from the demand charts, composite demand curves were plotted as shown in Figs. 3 and 5. These composite curves show for each hour out of the 24-hour period what per cent of the total daily kilowatt-hour consumption was used during that hour, including the basement. Each curve is the average of six typical days during the heating season.

From Fig. 3 it can be seen that the addition of automatic temperature control and a time clock set to turn off all power, except in the basement and bathroom, from 11:30 or 12 at night to 6 a.m. caused the maximum demand in the uninsulated house to be increased and shifted to between 6 and 7 a.m.

The effectiveness of the storage heaters in allowing most of the power to be used during off-peak hours is indicated in Fig. 5.

Types of Heaters and Control

The types of instantaneous electric heaters in use during the tests are shown in Fig. 4. The heaters were portable and were arranged for plugging into 220-volt outlets. Most of the heaters were provided with three-heat snap switches, which were found very desirable for the best operation of the heaters. Two general types of instantaneous heaters were in use, the radiant and the convection.

The radiant type of heater has the heating elements exposed to view and supported on some sort of refractory material. The heating elements operate at a bright red heat, so that heat energy is radiated out directly into the room. Such heaters are suitable for placing in fireplaces as they give the effect of radiant gas fires without any objectionable fumes or without the consumption of the oxygen in the air. They warm the bottom of the room first. When one stands exposed to the radiation they give a feeling of warmth even when the air is cold. The radiant type of heater is probably the most efficient type to use when a quick heat is desired, as its effects can be felt as soon as the power is turned on.

The radiant type of heater must be in plain sight to be of much benefit. The popularity of a particular model of the heater would, therefore, be dependent in a large measure upon the personal tastes of individual house owners.

The convection type of heater has the heating elements concealed from view and operated at a low temperature. The heat is distributed around the room by convection. The air near the heater, being warmed, rises, to be replaced by cooler air. This type of heater can be made similar in construction to an ordinary steam radiator, or, better still, be completely hidden from sight.

The convection type of heater has the disadvantage that the top of the room must be heated first, so that

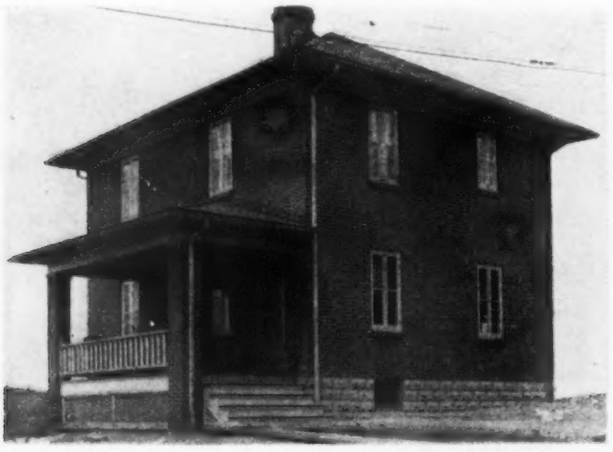


Fig. 6 (left) cork-insulated house and Fig. 7 (right) uninsulated house

convection heaters are not as suitable as radiant type heaters where a quick heat is desired.

Both the radiant and convection types of heaters readily lend themselves to automatic temperature control, which cannot be said of storage heaters. Individual room thermostats of the various manufacturers were in use, the two general types being the bimetallic three-wire type and the two-wire type with sylphon bellows and tilting mercury switches. Both types were satisfactory and reliable in operation. The thermostats or their auxiliary relays were in series with the magnet coils of alternating-current contactors in the basements of the houses. Contactors were necessary in order to handle the heater currents. It was soon found that alternating-current contactors were too noisy for this application, not on account of the noise of the opening and closing, but on account of the hum and vibration caused by the 60-cycle closing coil current when the contactors were closed. Some other type of contactor, possibly of the latch in type, or else one using rectified alternating-current, would probably have been more desirable.

The best arrangement would be to have the thermostats in the rooms interrupt the heater currents directly. This would greatly simplify and cheapen the control wiring system, as no control wires would have to be run to the basement. So far as the writer knows, there are no thermostats on the market at present which are capable of interrupting heater currents of 20 or 30-amp., 220-volt alternating-current. The three-wire thermostats had to be used with auxiliary relays which were large enough to handle contactor coil currents, but which were not large enough to interrupt the heater currents. The two-wire thermostats were much better and cheaper because the thermostats themselves have rated interruping capacities of 10 amp. and so do not require auxiliary relays for handling contactor coil currents. In many cases it would require more than one or two of the present two-wire mercury switch type thermostats to handle the current requirements for a single room. A two-wire thermostat capable of handling the heater requirements of several kilowatts could probably be developed if there was a sufficient demand.

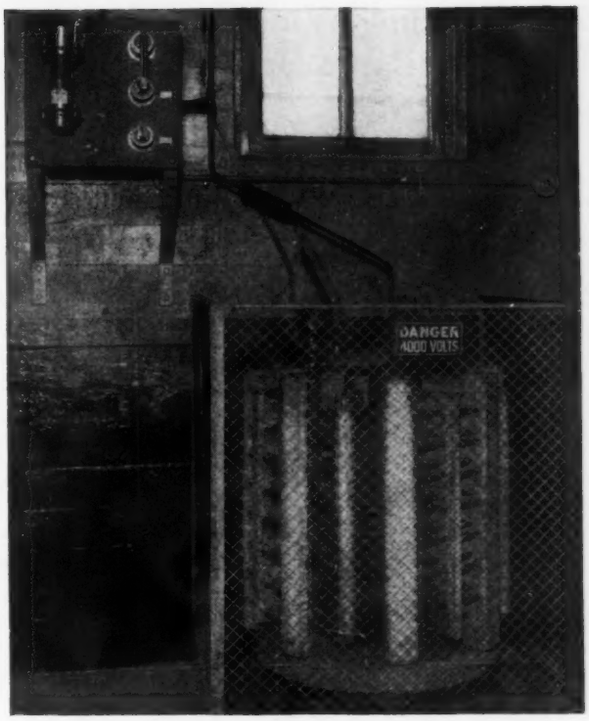
The second part of this article will appear in an early issue.

Neutral Reactors Have By-Pass Fuse

By H. E. Wulfing
Commonwealth Edison Company, Chicago, Ill.

TO LIMIT the destructive effect of line short circuits on substation equipment it has often been found advisable to install reactors in the outgoing feeders. The application of reactors to four-wire, three-phase circuits, such as those in the 4,000-volt distribution system of the Commonwealth Edison Company, is, however, a matter for thought. It is obviously out of the question to put reactors in four-circuit conductors on account of the expense and the fact that most short circuits are to ground, or, at least, start there. But a simple reactor installation in the neutral invites difficulty with voltage regulation when the load on the circuit becomes unbalanced, a condition which at some period of circuit operation it is practically impossible to avoid.

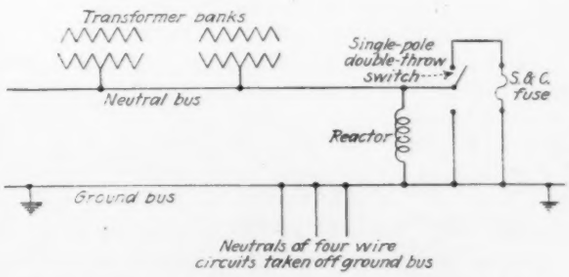
The problem is met at reasonable cost on the Commonwealth Edison system by the use of neutral reactor with a fuse bypass. One reactor serves for all transformer banks and circuits in a substation. It is connected between the neutral and the ground buses and a carbon tetrachloride-type fuse connected around it. As shown in the sketch, the installation is completed with a single-pole, double-throw knife switch so that the fuse may be cut and cleared or the reactor short-circuited. The fuse used is a 400-amp. Schweitzer & Conrad unit.



Fuse and reactor installation in substation

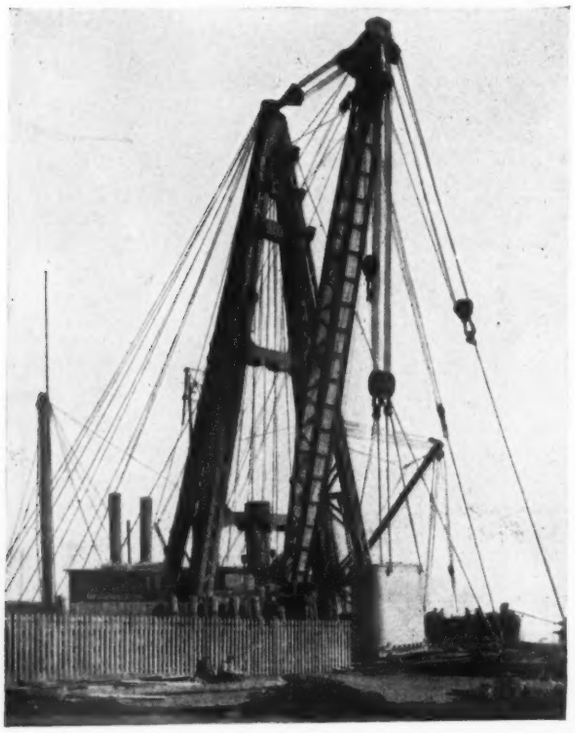
With this arrangement the fuse provides a direct, non-inductive, low-resistance connection between the neutral and ground buses, so that under regular service conditions there is practically no potential difference between the two and there is no probability of voltage regulation troubles on the circuits. In the case of failure of a circuit cable from phase to ground the fuse blows before the oil breaker on the circuit can open. The reactor is then in circuit to protect the breaker.

The experience of the company with this arrangement in nearly all of its 60-cycle distribution substations indicates that the scheme has much merit. During the years 1926, 1927 and 1928 to date there have been approximately 400 successful operations of the device. The cost of fuse replacements has been kept to the minimum by letting circuits ride through electrical storms on the reactors after fuses are blown. When the storm has passed the fuses are replaced.



Fused reactor in station neutral connection for 4,000-volt, four-wire circuits

Unloading Transformer with Barge Derrick



WATER transportation affords a more convenient means of conveying heavy equipment to some of the Manhattan Island generating stations than any other. The transformer shown in the accompanying illustration is for an extension to one of the United Electric Light & Power Company's stations.

Heat Distribution in an Electric Furnace

By B. M. Riker*

Industrial Heating Engineer
Charles H. Tenney & Company, Boston

A TYPICAL analysis of the heat distribution of a Kenworthy bright annealing furnace is as shown in the following table:

Charge	10,000 lb.
Heating period	1 hour 20 minutes
Heating chamber temperature	1,100 deg. F.
Average temperature of copper at end of heating period	760 deg. F.
Room temperature	60 deg. F.

The heat absorbed by the copper is:

$$\text{Kw.-hr.} = \frac{\text{(Wt. of charge} \times \text{Sp. Heat} \times \text{temp. rise)}}{\text{divided by 3,412}}$$

$$\text{or } \frac{10{,}000 \times 0.1 \times (760 - 60)}{3{,}412} = 205 \text{ kw.-hr.}$$

Total losses by test, including heat carried out by steam, loss through walls and through bottom seal are 79 kw.-hr. per hour, giving a total energy input for the charge of

205 plus (79 × 1.33) or 305 kw.-hr.

It appears from the above that the operating efficiency under these conditions is 61 per cent, or about 29 lb. of annealed copper per kilowatt-hour. Where wire is wound on spools, as with smaller sizes, the economy is lowered on account of heat absorption by the spools. The record of one electric furnace of this type when annealing various sizes of wire with charges ranging from 6,000 to 8,000 lb. shows the following:

Average production, 5,000 to 6,000 lb. per hour	
Pounds per kilowatt-hour for plain coils	28
Pounds per kilowatt-hour for spooled wire	20

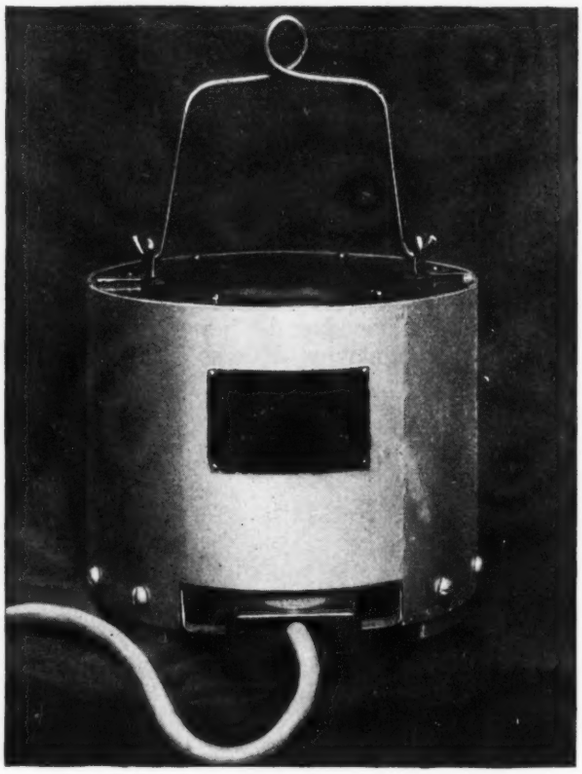
The labor costs on this type of furnace are confined to one man to load and unload. Maintenance costs are very low and repairs can be cared for at night or during week-ends. Average figures for a number of installations range from 17 to 25 lb. per kilowatt-hour for plain copper coils and from 12 to 17 lb. on spools. In open annealing from 20 to 30 lb. per kilowatt-hour are obtained.

*From James H. McGraw N.E.L.A. prize essay, 1928.

Electric Solder Pot Used on Underground Work

By H. T. Rogers

Assistant Superintendent of Underground Construction
New York & Queens Electric Light & Power Company



AN ELECTRIC solder pot that has a very low center of gravity, preventing it from overturning easily, is being used by the New York & Queens Electric Light & Power Company. The absence of flame and smoke are other noteworthy advantages attributed to this type of solder pot. Four different heats may be obtained by placing the plug in the proper positions. The device operates on 220 volts. Power for its operation is tapped from the sectionalizing switches used in the underground system. The time required to heat the solder is fifteen minutes, the same as that required by the gasoline-fired pot.

A New Development in
Oil-Filled Cable Design

Sectionalized balanced pressure design of three-conductor liquid oil-filled cable. Description of 33-kv. installation in Chicago and data on construction and tests

By G. B. SHANKLIN and V. A. SHEALS
Central Station Engineering Department, General Electric Company

THE present installations of liquid oil-filled cable in New York and Chicago, described in the symposium "132,000-Volt Single-Conductor Cable," *Journal* A.I.E.E., February, 1928, have confirmed all preliminary experiments and justified the soundness of the principles involved. These installations have operated without electrical failure up to the present time.

Further improvements should be in the nature of simplification in design, installation, operation and maintenance, taking advantage of all possible economies. With this in mind, the General Electric Company worked out what might be called a "sectionalized, balanced pressure" design of oil-filled cable line which will be briefly described in this article.

The Commonwealth Edison Company has just completed an installation of this type, from which invaluable experience should be gained, leading to additional improvements and modifications, some of which are already apparent. We wish, here, to give the Commonwealth Edison Company all possible credit for its progressive spirit and co-operation in giving us an opportunity to make a commercial installation of a new type of oil-filled cable. Before describing the present installation a description of the "sectionalized, balanced-pressure" plan will be outlined.

DEPARTURE FROM ORIGINAL OIL-FILLED CABLE

The main points of departure from the original oil-filled cable plan are listed below:

(a) The reels of cable are shipped and installed under oil pressure without draining the oil from the channels. This is made possible by supplying each reel length with a relatively small pressure reservoir, mounted as shown in Fig. 7. Maintaining the lengths of cable under oil pressure not only insures cable free of air and moisture but also eliminates the complicated and expensive field vacuum and reimpregnating treatment that was necessary on the original installations.

(b) Instead of having the channels in the form of a hollow core inside the conductor, they are placed in the filler spaces, as shown in Fig. 4. These channels are consequently at ground potential instead of full-line potential, allowing easy entrance at any point desired for purposes of oil feed, segregation, withdrawal of oil samples, etc. (In the case of single-conductor cable the same results are accomplished by placing the channels directly under the lead sheath). With the hollow-core type cable these points of entrance can be made only by the insertion of "stop joints" of rather complicated design.

(c) A type of "semi-stop joint" which is very simple in design and construction is shown in Fig. 6. This joint is used for connecting the reel lengths of cable in place of the regular joints used in ordinary installations. The purpose of the cork seal or plug placed at each end is twofold: First, during installation it allows work on the joint proper to be done while oil pressure is maintained on the cable, preventing drainage of insulation and entrance of air; second, for all practical purposes it segregates each length of cable from adjacent lengths, so that in case one length bursts open in operation, due to electrical failure or other causes, oil is drained only from the defective length (which must be replaced anyhow) without possibility of involving other lengths. Replacement after failure is accomplished in much the same way as with ordinary "solid" cable. In fact, the whole purpose of this general plan is to make the installation and maintenance of oil-filled cable approach a degree of simplicity comparable with that of "solid" cable.

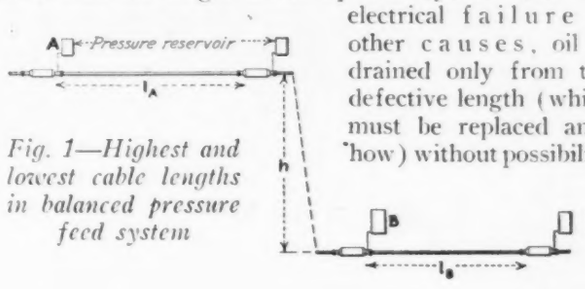


Fig. 1—Highest and lowest cable lengths in balanced pressure feed system

(d) Each segregated cable length has its own individual reservoir feed. The line is consequently served in much the same way that high-voltage, "solid" type cable lines are today in this country; that is, relatively small oil reservoir units are distributed along the line, being placed in the same manholes with and connected directly to the splices. These reservoir units are of the balanced-pressure type, as will be described, costing but little more installed than pressure reservoirs.

(e) A considerable saving is made by eliminating the reinforced double-lead sheath and using instead a single sheath of the ordinary kind, except that it is made of lead alloy to obtain greater mechanical strength. As far as we can determine, an alloy sheath should safely withstand a maximum operating oil pressure of at least 15 lb. per square inch. The present installation in Chicago is now adjusted for a maximum pressure of 12 lb. The practical experience which will be gained from this installation should prove of great value. The installation is so laid out that the pressure adjustment on the reservoirs can be decreased or even increased as desired, depending upon the future behavior of the sheath. Segregation of the cable line into short sections allows the maximum pressure to be kept within a conservatively

low value and, if this installation is successful, points the way to an appreciable economic saving.

The "semi-stop joints" are designated as such to distinguish them from the more expensive and elaborately designed true "stop joints" and because of the fact that the cork seals, while stopping a free flow of oil from one section to another, allow a slow seepage of oil around the seal through the cable insulation. This seepage is quite small, being in the order of 20 cu.cm. per hour past a single seal per pound pressure difference. Through the

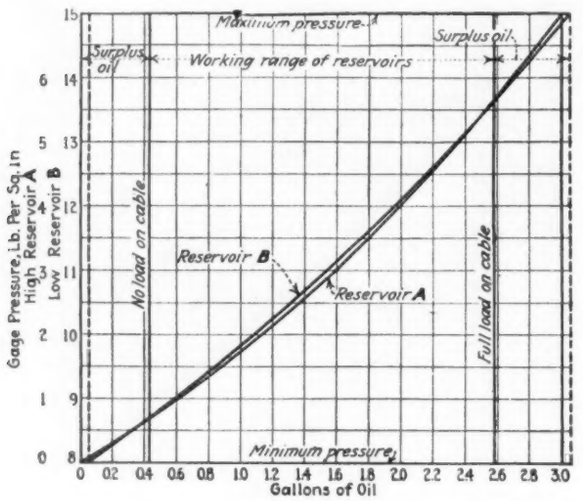


Fig. 2—Pressure-volume characteristics of balanced pressure reservoirs. No temperature correction

V_t = 9.3 gal. for reservoir A. V_t = 12.76 gal. for reservoir B.

complete joint with two seals in series it is, of course, half this amount.

Seepage is so slow that in case one section or length of cable bursts open due to electrical failure, allowing the oil in that section to escape, adjacent sections would not be drained of oil for many hours, giving repair men plenty of time to locate and stop the leakage before damage is done.

Under normal operating conditions, however, this slow seepage past the cork seals would in time produce an undesirable or even dangerous condition if allowed to exist. Such seepage could be caused by differences in elevation or differences in pressure of the various sections. The reservoir or reservoirs in that section of lowest relative pressure would receive oil and sooner or later become overcharged. Increased temperature produced, for instance, by sudden loading would expand the oil in the cable, and since this expansion could not readily be relieved by the already overcharged reservoirs a dangerous pressure might result.

This objectionable feature can be overcome in one of two ways:

(a) By using true stop joints in every manhole in place of semi-stop joints.

(b) Prevent seepage of oil past the semi-stop joints by maintaining equal oil pressures on each side of each semi-stop joint.

After giving this problem careful study we have come to the conclusion that method (b) holds the most promise from an economical and practical standpoint. Method (a) depends largely upon the cost and size of true stop joints, but there are other objections to it, the most important being that excessive surplus reservoir capacity must be used to guard against drainage of the cable by small leaks. In method (b) a leak in one section will cause unbalance of pressures and the entire system of reservoirs will feed oil to this leak by seepage of oil through the semi-stop joints. Recent developments have materially reduced both cost and size, but the true stop joint is still far from being on a comparable basis with either ordinary joints or semi-stop joints and must still be used only sparingly.

Maintaining equal pressures on each side of the semi-stop joints is accomplished by a system of balanced-pressure reservoir feed, the reservoirs working together in harmony and synchronism. As the cable heats and cools the pressures in the reservoirs of the respective sections increase and decrease by substantially the same amounts. In this connection it will be understood that the respective expansible reservoirs are so designed and adjusted as to size, gas and oil content, diaphragm characteristics, relative elevations or contour and with regard to the length of cable section which they serve that the desired result, as above set forth, is obtained.

In the Chicago installation it so happened that all of the reservoirs and the joints to which they were attached were at substantially the same relative elevations, as can be seen from the profile in Fig. 3. This made the problem of balancing quite simple and allowed the use of the same design of pressure reservoir (see Fig. 5) that has been used with ordinary "solid" cable for some time past.

Where the contour is irregular, however, with the joints at different elevations, it is advisable to modify this design to obtain the desired balance more readily. We regret that drawings of the modified design are not yet available. It is identical in principle with that shown in Fig. 5, the chief difference being that the positions of the gas and oil are reversed; that is, the oil is inside the flexible cells, all of which are connected together. Also, the back pressure or resistance to movement of the diaphragms is smaller. This design allows very exact

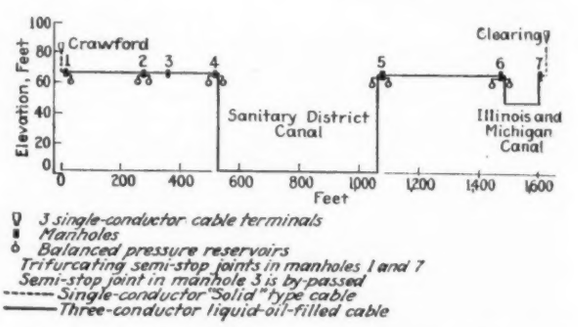


Fig. 3—Three-conductor oil-filled cable profile and location of joints, reservoirs and terminals

balancing regardless of contour, the final adjustment of oil volume, gas volume and pressure being easily made in the field after the line is completed.

Pressure Reservoir Formula

The formula for a pressure reservoir of this type is given below, ignoring the back pressure of the diaphragm, which is allowable since it is not only small but is practically the same for all reservoirs in the balanced system:

$$P\ (v_t - v)\ (T' + 273) = P'\ (v_t - v')\ (T + 273) \quad (1)$$

Where:

v_t = Total working volume of gas and oil per unit length of cable.

P' = initial pressure (absolute).
v' = initial working volume of oil per unit length of cable.
P = variable pressure (absolute).
v = variable working volume of oil per unit length of cable.
T' = initial gas temperature in degrees C.
T = variable gas temperature in degrees C.

Let

l = the length of cable served by reservoir.

Then,

$$V_t = v_t l,\ V' = v' l \text{ and } V = vl \qquad (2)$$

Also

let h = difference in elevation of any reservoir in reference to highest reservoir (A) in system, expressed in terms of pounds per sq.in. oil pressure.

Then,

$$P_1' = P_a + h_1,\ P_2' = P_a + h_2 \ldots P_n' = P_a + h_n, \text{ etc.} \qquad (3)$$

For a balanced system, therefore, the formula is given below, from which the cyclic exchange of oil or degree of unbalance can be determined, assuming uniform temperature along the cable line:

$$V_1 + V_2 \ldots + V_n = V_{t1} - \frac{P_1'\,(V_{t1} - V_1')\ (T_1 + 273)}{P_1\ (T_1' + 273)} \text{ etc.} \qquad (4)$$

The highest reservoir (A) and lowest reservoir (B) in a system determine the characteristics of all the other reservoirs and also determine the minimum and maximum values of v_t; that is, reservoir A has minimum v_t and reservoir B has maximum v_t. We need then only consider the lowest and highest sections of cable as shown in Fig. 1.

Example of System

As a concrete example of how such a system is laid out let us assume, referring to Fig. 1:

h = 20 ft. = 8 lb. oil pressure.
l_A = 500 ft.
l_B = 500 ft.
V_A = 3 gal. total working oil capacity, including the necessary surplus for safety.
V_B = 3 gal. total working oil capacity, including the necessary surplus for safety.

Obviously, reservoir A should work between pressure limits 0 and 7 lb. and reservoir B between 8 and 15 lb., since the minimum pressure is fixed at atmospheric (zero) and maximum at 15 lb. for sheath without reinforcement.

The pressure-volume characteristics of reservoirs A and B are given in Fig. 2. It will be noted that the curves coincide very closely. The pressure-volume curves of all other reservoirs in the system would fall between these two, depending upon their relative elevations, consequently the cyclic transfer of oil from one section to another is negligibly small over the full working range of the reservoirs, provided the temperature along the cable line is uniform. This never being strictly true, there will be an additional and larger cyclic transfer of oil due to this unequal temperature. It may amount to 10 per cent of the total cable requirement, but rarely would exceed this under ordinary conditions. A surplus reservoir capacity of 40 per cent or more would, consequently, take care of this and still leave an additional surplus of 30 per cent or more for other unforeseen requirements. In those cases where temperature unbalance along the line is very pronounced it can be properly allowed for in the original reservoir layout.

It can be seen from the foregoing that a maximum difference in elevation of only about 20 to 25 ft. can be taken care of by this method of balanced-pressure reservoirs without exceeding 15 lb. maximum pressure. This limit could be increased to 30 lb. (50 to 55 ft. difference in elevation) by using reinforced sheath where required. In any case, true stop joints must be inserted at those points where the maximum allowable pressure is exceeded, thus dividing the line into true sections for the carrying out of the plan.

Where rugged profile is encountered it is simply a question of comparing the additional cost of reinforced sheath with the cost of additional true stop joints.

Unquestionably, from an economic standpoint this plan of segregated, balanced-pressure feed lends itself best to fairly level or gradual profile. The majority of cable conduit profiles in our big cities are of this class and doubtless there will be many possible applications of this plan if it works out successfully in the present Chicago installation.

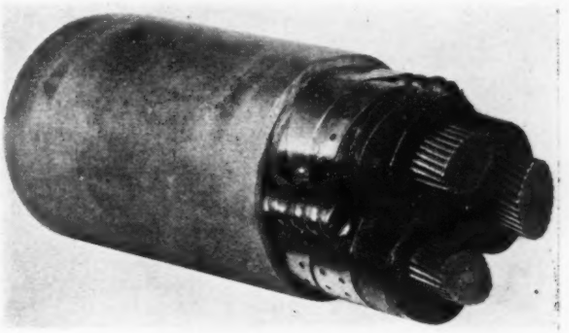


Fig. 4—Three-conductor, oil-filled, paper-insulated cable showing arrangement of parts

Installation of Three-Conductor Liquid-Oil-Filled Cable in Chicago

The cable is illustrated in Fig. 4. Each of the three conductors is made up in semi-sector shape, the central part being preformed to a sector shape, around which are stranded 54 wires in three layers, making a total cross-section of 350,000 circ.mils.

Each conductor is insulated with 0.280 in. of wood pulp paper and covered with a 0.75-in. x 0.005-in. perforated copper tape, put on with an opening between turns not to exceed 0.094 in. The usual center and side fillers are omitted and in place of the side fillers copper tubes, 0.4 in. in outside diameter, made up in the form of General Electric BX type conduit, are substituted. These fillers are so made that the oil can flow freely in a lateral direction in or out of them. Thus all the free space between the sheath and conductors is available for oil channels. Over the three conductors and copper fillers is a 1.0-in. x 0.004-in. steel tape put on with a 0.625-in. opening.

The lead sheath is applied directly over the steel tape. The sheath is 0.156 in. in thickness and is made of lead alloyed with 2 per cent tin to give mechanical strength against internal pressure.

The cable section which crosses under the Sanitary District Canal (Fig. 3) is armored with 48 galvanized steel wires 0.134 in. in diameter. The lead sheath is first coated with asphalt, then a layer of rubber-filled tape and a second coat of asphalt. The armor wires are put on with a short pitch (approximately 45 deg.) in order to give mechanical support to the lead against the high internal pressures to which it would be subjected in case the water in the tunnel shaft is pumped out.

The plain leaded cable has an outside diameter of 2.7 in. and the armored section of 3.2 in.

Tests and Guarantees

The high potential tests were as follows:

Each reel 60 kv. alternating-current—15 minutes.
Cold bent sample 96 kv. alternating-current—5 minutes.
75-ft. sample 60 kv. alternating-current—24 hours.

The armored section was tested after armoring at 48 kv. alternating-current for five minutes.

The guaranteed maximum dielectric loss and power-factor at 20 kv. were as follows:

Temperature, deg. C.....	room and	40	60	80	100
Per cent power factor.....	0.75	1.0	2.0	4.0	
Watts loss per foot, single phase...	0.12	0.16	0.32	0.65	

Actual measurements of power-factor and dielectric loss at 60 deg. C. were about one-third of the guaranteed values.

The guaranteed maximum change in power-factor between 20 and 100 volts per mil. was 0.5. Factory measurements showed this change in power factor to be about one-tenth of the guaranteed values.

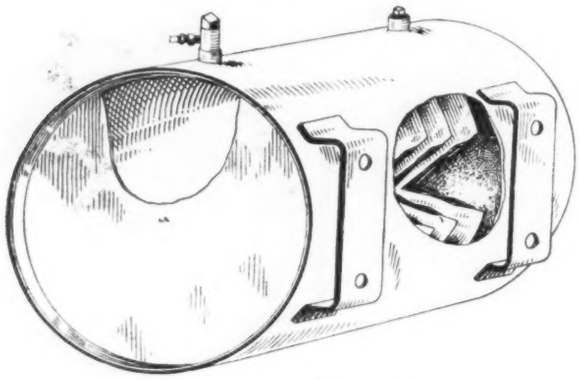


Fig. 5—Oil reservoir for cable joints

The field acceptance test was set at 103 kv. direct current for fifteen minutes, but due to limitations of available testing equipment it was made at 95 kv. direct current.

The cable was treated and oil filled in the factory after the lead sheath was applied. This method of treatment is described in the article on 132,000-volt cable previously mentioned.

After treatment in the factory, instead of draining the oil from the channel spaces and vacuum treating and refilling in the field the cable was shipped full of oil. To insure perfect impregnation and prevent entrance of air into the cable during shipment a small pressure reservoir was mounted in the body of each reel and connected to the end of the cable.

The capacity of these reel reservoirs was sufficient to maintain the cable at a pressure always above atmospheric, over the temperature changes encountered during shipment. The method of mounting these reservoirs in the reels is shown in Fig. 7. The connection between cable end and reservoir is flexible and has two shut-off valves with a pipe union connection for ease of connection or disconnection. The short section of pipe between the valves which contains the pipe union is arranged with a small vent plug for flushing out the trapped air so that connections could be made without the use of vacuum to displace this air.

Route of Cable

The cable is installed between the Crawford station of the Commonwealth Edison Company in Chicago and a 33-kv., three-phase overhead transmission line of the Public Service Company of Northern Illinois which connects with the latter company's clearing substation. The cable line after leaving the Crawford station property crosses the Sanitary District and Illinois and Michigan Railroad canals. The total length of three-conductor cable installed is approximately 1,800 ft. The profile of the cable is shown in Fig. 3.

There are tunnels under both canals and in each case the cable is pulled through ducts. The former canal is 65 ft. deep and the latter 18 ft. deep. It was deemed advisable to reinforce the lead on the deeper tunnel section, as has been previously mentioned.

It will be noted that all of the manholes in this conduit line are at practically the same level. The only portions of the profile which extend above the manhole level are the risers to the terminals.

Terminals and End Sections

The scheme of balanced-pressure reservoirs has already been described and mention has been made of the semi-stop type of joint.

Since the development of a true oil stop joint for three-conductor cable was not completed at the time that this cable line was planned it was necessary to design the risers to the terminals so that there would be no flow of oil from them into the cable itself. This was accomplished by making these risers of single-conductor "solid" type cable and using terminals filled with a heavy non-migrating compound. These single-conductor cables have a 500,000-circ.mil conductor, 0.407-in. paper insulation and a 0.109-in. lead sheath. They are spliced to the three-conductor cable by means of a trifurcating joint which has a semi-oil stop in the three-conductor end. Similar single-conductor cables are in general use on the Commonwealth Edison Company's system at 33 kv. for terminating three-conductor cable lines.

Balanced-Pressure Reservoir

The oil reservoirs connected to the cable are of the pressure type, having internal flexible-metal, gas-filled cells inclosed in a tight sheet-metal tank. This type of reservoir is illustrated in Fig. 5.

In order to keep the reservoir pressures balanced so there will be a minimum transfer of oil from one section of cable to another the reservoir capacities are proportional to the length of cable to which they are connected. This is accomplished by varying the number of cells in the reservoirs.

The reservoir capacities are such that they will take care of the expansion and contraction of the oil in the cable over a temperature range of 75 deg. C., the corresponding pressure range of the reservoir being from 2 to 12 lb. per square inch, gage pressure. An ample surplus of oil capacity is allowed, since the reservoirs have a complete pressure range of 20 lb.

A complication is introduced by the fact that unequal temperatures in various sections of cable would cause

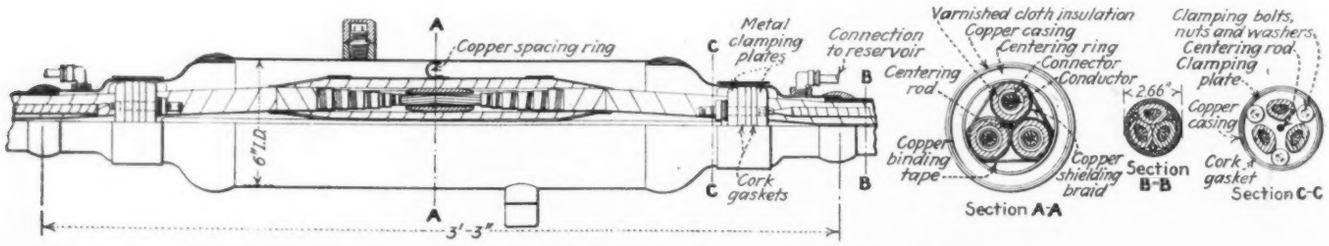


Fig. 6—Semi-oil-stop joint for 33-kv., three-conductor oil-filled cable

unbalance in pressure and transfer of oil through the semi-stop joints. Small unbalances of this nature would not be serious, since the oil transfer would be small and would have a tendency to be compensating, but in the case of the two tunnel reservoirs which are submerged in water the difference in temperature variation, and therefore in pressure, would be too great to permit the usual reservoir design.

To adapt the reservoirs to this condition account was taken of the lower temperature rise in the tunnel sections and the number of cells in the reservoirs feeding these sections was proportionately reduced in accordance with estimated service requirements.

It will be noted from Fig. 3 that every cable section except the short one at the clearing end of the line has a reservoir feeding it from each end. Reservoir feed from each end of the cable sections has the advantage of a more positive feed to the cable and the maintenance of more nearly equal pressures on opposite ends of the joints during transient temperature changes. Fig. 6 shows the type of semi-stop joint used on this cable. The central part of the joint is not materially different from the ordinary completely shielded three-conductor joint.

The semi-stop oil seals at each end consist of cork gaskets which make a tight sliding fit over the copper tape shielding of the three single conductors. Alloy clamping plates with bolts, nuts and spring washers serve to compress the gaskets to about one-half their original thickness, compressing them tightly against the joint casing and conductors. Openings are provided for connection to the oil reservoirs. The trifurcating joints have a semi-stop in the three-conductor end only.

Installation of Cable and Reservoirs

The pressure reservoirs were shipped filled with degasified oil and were installed previous to pulling the cable. Each reservoir is equipped with a cone type shut-off valve with a sealing cap and gasket. A similar valve is mounted near the roof of the manhole and connections made as shown in Fig. 9. This piping was all carefully flushed out and filled with oil from the reservoir before connecting to the joint.

As soon as the cable is pulled in the reservoir is temporarily connected to it, so that it is kept under oil pressure until the jointing is started. All these connections are made without the use of vacuum, taking care to flush out all trapped gas.

The pulling eyes of the cable were applied at the factory and an opening was provided so that reservoirs could be connected to them when necessary.

There are several precautions which must be observed in an installation of this kind, viz.:

1. Oil pressure reservoirs (either the permanent ones or temporary portable reservoirs) must be attached to the opposite ends of the cables being joined.

2. The cable ends being joined must be bent upward sufficiently to form an oil trap, to prevent entrance of air into the cable, before the ends are cut and until the cable end is vacuum treated and put under oil pressure. It is preferable to have the final position of the joint above the cable entrances to the manhole.

3. Both ends of any particular cable length must not be opened simultaneously.

Fig. 8 shows the first step in making the joint. The cable ends are bent up, as shown, and the pressure reservoirs at the far ends of the cables are shut off. The cables are then cut to length and the end assembly of the joint is applied to the cable ends. As soon as the end sections of the casing are "wiped" in place the cork gaskets are compressed. The reservoirs at the far ends of the cable are turned on and oil flows through the cable and displaces the air trapped in the cable ends. The piping of the permanent reservoirs is then connected to the ends of the joint, as shown. All connections are made with $\frac{1}{4}$-in. copper tubing and compression fittings, which allow connections to be made with the oil flowing from both the joint casing and the piping.

With oil pressure on the cable, it was found that the cork seal effectively stopped any leakage of oil from the channels, but allowed a slow seepage of oil through

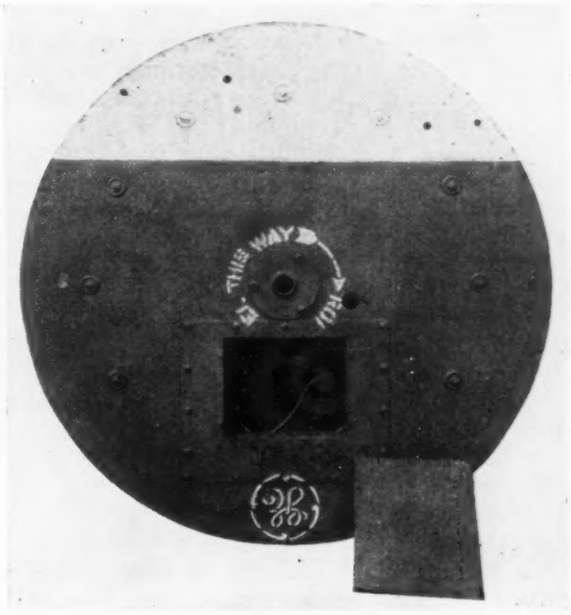


Fig. 7—Reel with oil pressure reservoir for shipping oil-filled cable

the insulation and the strands, keeping the exposed cable ends from draining and absorbing air.

The connectors are "sweated" on and the installation is stepped in the usual manner. A loose protective wrapping of tape is applied over the stepped insulation surfaces. The casing is next put in place and sealed with temporary lead wipes. The joint is now made up provisionally. Vacuum and oil-filling equipment are connected, as shown in Fig. 9, the oil reservoirs shut off, and the joint and cable ends are given a short vacuum treatment. They are then filled with oil from the portable pressure reservoir and the reservoirs connected to the cable are again turned on, putting the cable under pressure.

The center part of the joint casing is "unwiped," moved over the cable end and the three conductors insulated with special varnished cloth and the metallic shielding is carried completely across the joint. A metal spacing ring centers the insulated conductors inside the casing. The central part of the casing is now "wiped" permanently in position.

A short-time vacuum is applied to the central position of the joint and it is filled with oil from the portable pressure type oil reservoir.

The total time required to make a joint in provisional form, treat it, complete the insulating and fill it was sixteen hours. With more experience this time could, no

doubt, be reduced. Usually the jointing operations were done in two parts, the provisional joint being made one day and the joint completed the next day in order to allow an adjustment of conditions.

After the cable was joined the reservoirs were adjusted to 5 lb. pressure, which was calculated to be correct for no-load conditions for the ambient earth temperature at the time.

This cable line is designed to carry a load of 15,000 kva. at 33 kv. under ordinary ambient temperature conditions without exceeding 65 deg. C. on the copper.

Pressure gages were installed on each reservoir and close observation of pressures will be kept until data on pressure balance is obtained.

Summary and Conclusions

It will be noted that the average stress on the insulation at 33 kv., three phase, is 68 volts per mil, which is only about 25 per cent higher stress than on "solid" cable of the shielded type. Since this is an initial installation, the object being to study installation problems, and the amount of cable involved is small, a large factor of safety in insulation thickness was allowed. The cable should be given a rating of 45 kv., three phase, and we would not hesitate to operate this same cable at 45 kv. without any increase in insulation thickness.

It is interesting to note that a 33-kv., three-conductor, 350,000-circ.mil semi-sector cable of the "solid" type, having an insulation thickness of 0.391 in., has an outside diameter of 3.3 in., whereas 45-kv., three-conductor oil-filled cable of the same copper cross-section has an outside diameter of 2.7 in. A 33-kv., three-conductor, 350,000-circ.mil oil-filled cable having 0.220 in. insulation would have an outside diameter of 2.5 in.

A close observation and study of the present installation has shown that we can very materially simplify the procedure followed on this initial line. Briefly, the changes would be as follows:

1. Maintenance of oil pressure on the next adjacent joints or cable ends, while drawing vacuum on the joint between. This would be accomplished by means of

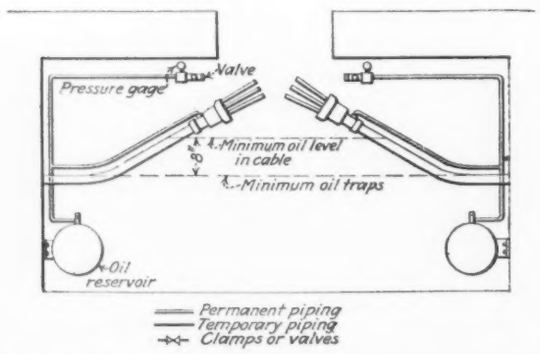


Fig. 8—Schematic diagram showing cable ends prepared in "bent-up" position preliminary to making the joint in provisional form

Cork gasket oil stops in place.

portable pressure reservoirs of 10 to 20 gal. capacity. This would eliminate any possibility of small leaks in wipes, sealing plugs, etc., which if present would allow air to be drawn into the cable and invalidate other precautions for a perfect installation.

2. Elimination of the provisional joint. The joint would be made complete and then given a vacuum treatment when finished, the cable ends being treated at the same time with pressure reservoirs connected at the opposite ends. This would result in a great saving of time and would allow the complete joint to be made in a reasonable working day.

3. The use of portable oil-handling equipment.

This method of installation with the simplifications described applies equally well to single-conductor oil-filled cables having oil channels under the sheath and may be advantageously used with them.

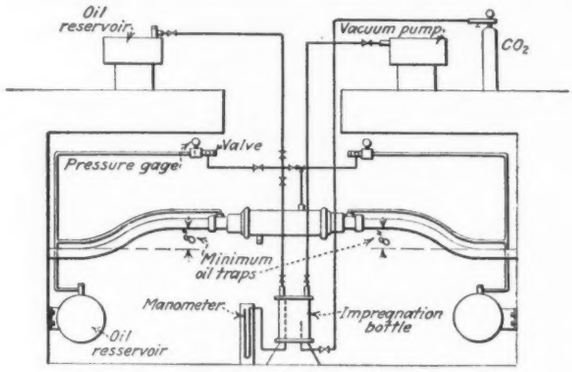


Fig. 9—Schematic diagram showing cable joint prepared provisionally with vacuum and oil-filling equipment connected

Note oil traps in cable on each side of joint.

Oil seepage through the strands and insulation of the three-conductor or "channeled-sheath" type of single-conductor oil-filled cable is so small that it can be maintained during soldering of the connectors with no danger of entrapping gas in the cable ends or of making poor soldered joints.

Oil-filled cable for 33-kv. operation may not be justified, since three-conductor shielded cable of the "solid" type is operating satisfactorily, but the oil-filled type has the advantages of smaller diameter, greater reliability and higher carrying capacity.

There would be much greater advantages at 45 and 66 kv. in cases where the blocks of power to be transmitted do not justify the use of multiple circuits of single-conductor cable. In many of these cases two oil-filled, three-conductor cables would take the place of six single-conductor cables.

A 66-kv., three-conductor oil-filled cable which would carry 30,000 to 35,000 kva. would still be of reasonable diameter. Savings would be made in duct space and induced sheath losses and more power could be carried per duct than with the largest single-conductor, 66-kv. cables. There would also be the advantage of more circuits and a correspondingly greater capacity under emergency conditions in case of a cable failure; that is, a single-conductor cable failure puts a whole circuit of three cables out of service, whereas a three-conductor cable failure takes only one cable out of service.

This initial installation of three-conductor oil-filled cable is a result of experience gained in the manufacture and installation of the 132-kv., single-conductor oil-filled cable. The installation has been materially simplified and cheapened and experience gained in this installation has pointed the way to still further simplicity and economy in cable design.

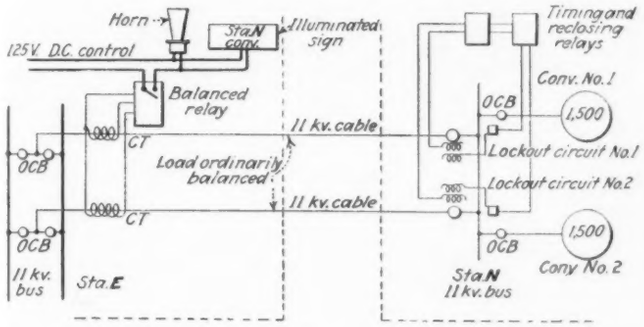
All novel features of the cable, semi-stop joint and reservoir design as well as the method of installation are the subject of patent applications.

Signal System for Unattended Substation Uses Balanced Relay

By R. B. Kellogg

Assistant Engineer
Pacific Gas & Electric Company, San Francisco, Calif.

THE presence of two 11-kv. feeders supplying a railway substation was taken advantage of by the Pacific Gas & Electric Company to apply a balanced-current relay to give a remote indication of oil circuit breaker operation. Station "N" is a full automatic, non-attended railway substation containing two 1,500-kw.



Balanced-current relay indicates shutdown of converter at distant unattended substation

synchronous converters. Power is supplied from station "E" over two 11-kv. cables which normally share the load. Since station "N" is located near the outer edge of the city of San Francisco it was desired to install some kind of a signaling system so that the operator at station "E" could immediately notify the maintenance department in case one or both converters should lock out at the unattended substation.

At station "N" a definite time relay and reclosing relay are installed to operate so that when either converter locks out the oil circuit breaker on one of the 11-kv. feeders will open. As may be seen from the accompanying diagram, the unbalance thus created causes the contacts of a balanced-current relay at station "E" to close, energizing a horn and illuminating a sign. At the same time the reclosing and timing relays at station "N" will reclose the 11-kv. breaker in five seconds, thus restoring the station to normal except the converter which locked out.

This scheme requires no telephone lines or signal circuits and represents no expense except the relays and connections, which cost approximately one-fourth that of ordinary commercial systems. It is appreciated that the scheme does not possess all the advantages, nor does it have the scope of some of the more expensive signaling systems available. However, it has proved satisfactory for the service required in this case.

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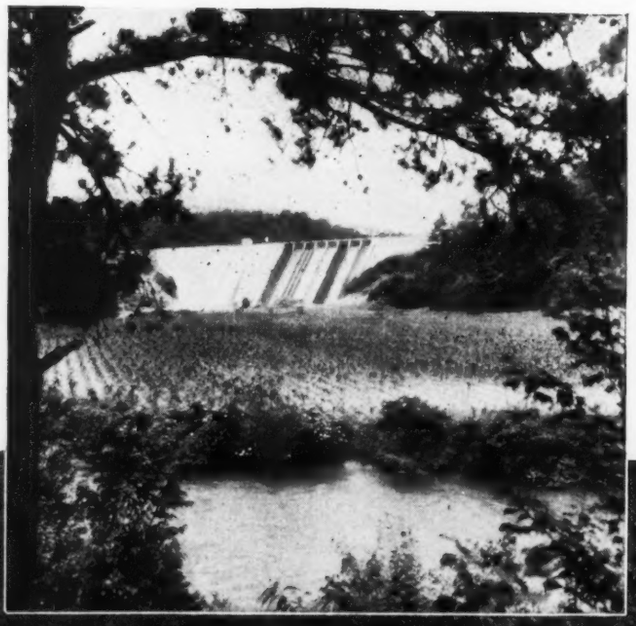
380 Ft.-Candles Light Prize Ring

LIGHTING equipment to facilitate boxing and hockey contests is a striking feature of the new Boston Garden, seating about 18,000 persons. The building is designed for varied entertainment purposes, but the requirements of the sport lighting are of special interest. For boxing the ring is illuminated by Holophane units in the form of 80 500-watt reflectors, mounted around the edges of a metal-supporting frame 26 ft. square, and four 1,500-watt reflectors of the high-mounting type supported in the center of the fixture. The frame weighs about 6,000 lb. light and 7,500 lb. equipped with lighting units. It can be raised and lowered through a range of about 60 ft. by a 5-hp. motor and hoist located on a "catwalk" in the roof structure and during boxing matches is carried at a height of about 20 ft. above the arena floor. The intensity in the ring is about 380 ft.-candles and enables snapshots of boxers in action to be taken by press cameras.

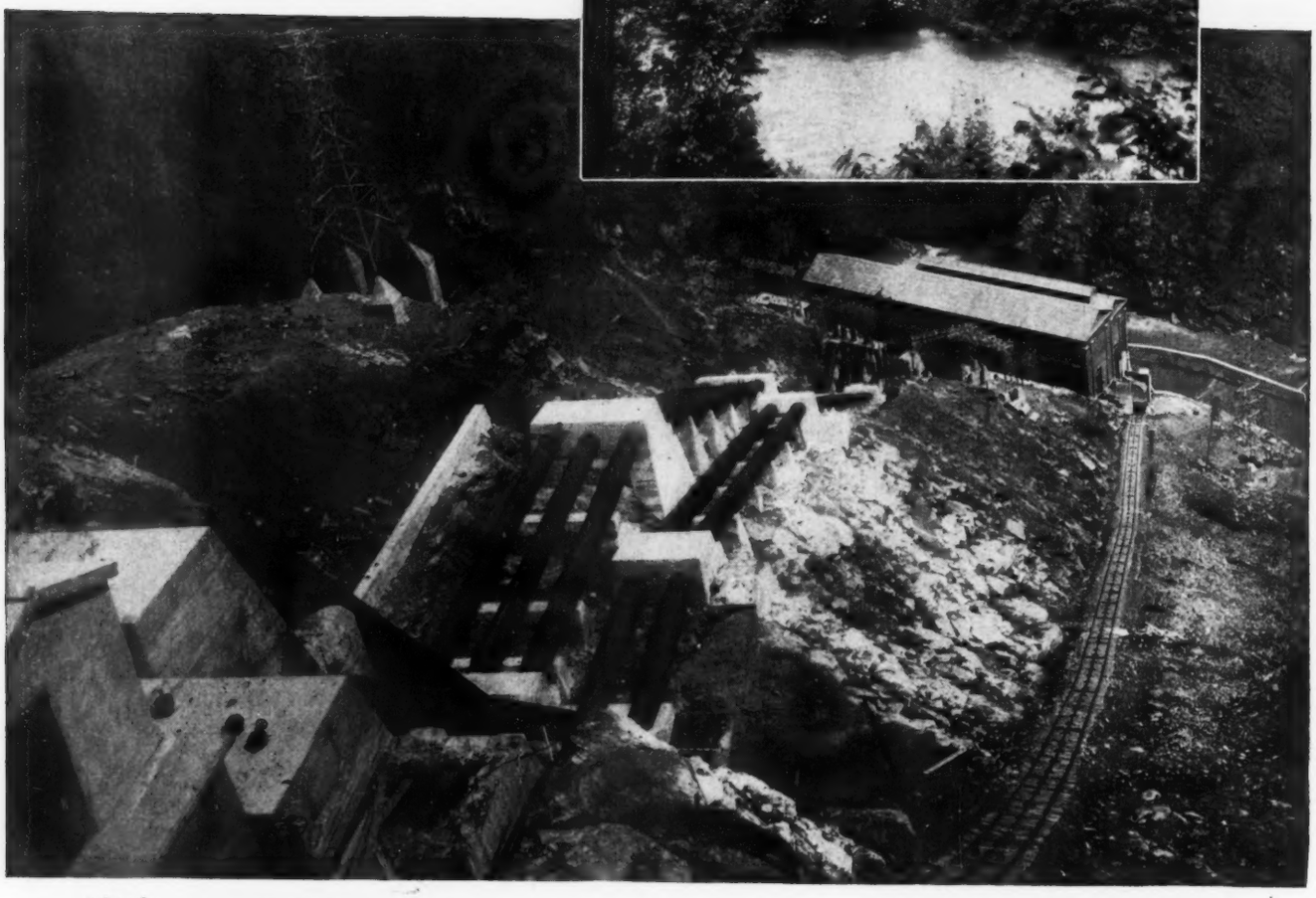
The main auditorium hockey matches are served by 77 Holophane units giving an intensity of 27 ft.-candles over the ice area and 37 ft.-candles near the nets. Over the nets of the goals are sixteen 1,500-watt units, 41 1,000-watt units being over the skating area and twenty 500-watt units over the balcony seats.

Prize ring lighting units aggregate 46 kw.

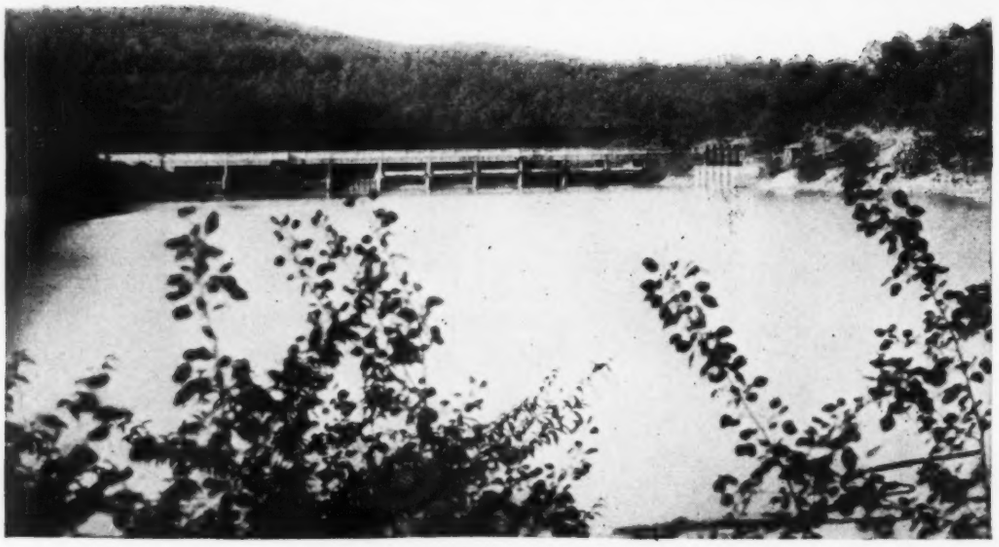
Notable Hydro Developments in Georgia



Lake Burton Dam impounds enough water to generate 100,000,000 kw.-hr.



A head of 608 ft. is possible at the Tallulah Falls development



Tallulah, one of six lakes owned by the Georgia Power Company. The power house is more than a mile from the dam

Commissioner Analyzes

Bases of Utility Criticism*

Public Service Commissioner examines recent attacks upon and defenses of the utilities and makes some suggestions

By WILLIAM A. PRENDERGAST
Chairman Public Service Commission of the State of New York

W. A. Prendergast

SOME of the grounds upon which attacks upon the electrical industry have been based are minor to the one issue which has seemed to be of most moment in this discussion. That is, the relation of the "holding company" to the electrical industry. In this subject there has been considerable public interest, and it may be said that it is the major point in the hostility that the industry has had to face.

The consideration which is important to the industry seems to me to be this—that such action as Senator Walsh suggested would not be undertaken unless it were supported by a sufficiently impressive public sentiment. While it may well be that a majority of the people of this country were not either favorable to, or interested in, such an investigation, the public interest awakened by the Walsh resolution certainly made it evident that it would be better for the interests of the industry that the charges of undue manipulation in the interests of the holding companies to the exclusion of those of the customers of the utilities should be disproved.

In the September issue of the *Atlantic Monthly* Maurice R. Scharff of Pittsburgh, Pa., charges that "serious abuses have established themselves" in the relationships of operating and holding companies. He maintains that exorbitant fees are charged the operating companies by the holding companies for financial, engineering and managerial services; that these fees are as much as 10 per cent and 20 per cent; and that these transactions are not unknown to the public service commissions. He then proceeds to make the familiar charge of a "partial breakdown of public service commission regulation which has characterized these last few years." This claim of a breakdown of regulation would not be important if it were not given the background of one of our oldest and most representative magazines.

Mr. Scharff is careful not to charge wrongdoing on the part of the holding companies, but alleges that they are exercising an unfair power over operating companies. He seems to think that a housecleaning by the industry is necessary, but the suggestion he makes for its accomplishment I shall not discuss, as it is effectively answered in the November issue by Philip Cabot, professor of public utilities in the Harvard Business School. His article is in some respects a very complete answer to Mr. Scharff, and at the same time he advances a unique defense of the electric companies, in which is included some apparently new but extremely vigorous criticisms of public service commissions and their methods of regulation.

Professor Cabot does not simply find fault with public service commissions, he indicts them. From whatever point of view one regards his strictures, he has certainly stressed the argument for the utilities from unusual angles. He admits that the reasoning by which some of his propositions can be sustained is technical, and it may therefore be discussed, as he suggests, at another time and place. There are certain of his propositions, however, to which a word even of a passing character may be given. Here are certain of his contentions.

1. That the basis of valuation now used by the commissions was never intended to be so used. That the theory of the Smyth vs. Ames decision has no place in present-day rate making.

2. That the commissions have been confiscating the profits of the utilities and this has forced managers to seek profits out of expenses charged to the consumers.

In respect to point number one, it cannot be maintained that valuation of the properties of public utilities has been brought to that exact state of method which is satisfactory either to the commissions or to the utilities. But it is a fact that the rule for finding valuation laid

> *. . . it would be better for the interests of the industry that the charges of undue manipulation in the interests of the holding companies to the exclusion of those of the customers of the utilities should be disproved.*
>
> *. . . there has not as yet been any impartial inquiry to determine whether the evils charged against the industry have any basis in fact.*
>
> *. . . the best thought of the industry must be exerted to furnish adequate corrections.*

**From address before the annual convention of the National Association of Railroad and Utilities Commissioners.*

down in Smyth vs. Ames was not a rule simply for the occasion of that litigation, but a rule which has been constantly reaffirmed by the Supreme Court of the United States down to the present time. If the court did not intend it to be a rule, why has it not criticised the constant recourse to that rule which has been made by courts and commissions? The history of valuation for the past ten years shows that this rule has been wrought into a formula and that this formula has been recognized by federal and state courts, although they have frequently rejected the use made of that formula. It may be that there is some better formula, but no one has so far suggested it, and the difference of opinion concerning valuation has principally hinged upon the point "What is the fair value of the property?" The utilities have not objected to the formula. They have insisted that fair value meant reproduction cost, as opposed to so-called book value. This formula or dogma has had general acceptance as a basis for determining valuation and was used in the New York courts in determining the application of the rent laws enacted as part of our housing relief scheme some eight years ago.

Charge of Confiscation of Profits

Concerning point number two, have profits been confiscated? If rates have been found to be too low the electric utilities have not been afflicted with any shrinking modesty in asking that a fair profit or return be allowed them, and in most cases they have had substantial justice. Utility managers have time and again asserted that all they required was a fair valuation and a fair return. Given a fair return they could pay their fixed charges and dividends and also provide for special contingencies and an allowance for surplus. It is a novel idea that the oppressive policy of the commissions has forced these holding companies to resort to devious ways in order to secure extra profits from the operating companies, but that is exactly what Professor Cabot alleges. It is asserted that the public service commissions have been the seducers of the virgin-minded managers of the holding companies. We are told that they have been made desperate and forced to find new fields from which to pluck the ripened fruit of managerial charges.

No, this is not the difficulty with the holding companies. The sole difficulty, and the public has taken cognizance of it, is that there has not as yet been any impartial inquiry to determine whether the evils charged against the industry have any basis in fact. Further, the public suspicion has been aroused by the fact that the capital issues of these holding companies are unregulated or uncontrolled by any public agency, a regulation and control which is urgently required in respect to those subordinate issues known as class A and class B stocks and other favored children of the marketplace. There is also sound objection to the idea that contracts for service of different kinds may be made between the holding and the operating companies without any public regulation. We also know that the industry has stubbornly resisted the imposition of regulation upon the holding companies, and this in itself does not promote public confidence. As explained in the beginning of this address, here is a splendid industry, one of the most useful servants of the public requirement and comfort. It numbers among its leaders some of the ablest men in the great army of American business. The industry itself is essentially sound. To the extent that financial manipulation may tend to cast a reproach upon it, the best thought of the industry must be exerted to furnish adequate corrections.

The High Cost of Glare

By M. Luckiesh
Director Lighting Research Laboratory, Nela Park, Cleveland

FOR years glare has been recognized as a costly evil which is a common, although unnecessary, byproduct of lighting. It is known—more or less vaguely—that glare causes eye discomfort, eye fatigue and reduced visibility. All these results are costly from the viewpoints of safety, comfort and productiveness of workers. Studies of discomfort and eye fatigue have been made,[1] but research methods are still insufficiently developed to provide satisfactory quantitative measurements. Many studies have been made of the effect of glare upon visibility or the ability to see details. However, the results have been fragmentary and are particularly lacking in range and co-ordination of various factors of vision.

After years of systematic research we are able to present for the first time quantitative results of glare in reducing visibility over a wide range of illumination levels (1.16 foot-candles to 116 foot-candles) and for a variety of relationships of contrast and size of object to be seen. From these we are able to determine the high cost of glare in wasted foot-candles and these can be easily evaluated in terms of dollars wasted. Even this is not the entire cost of glare, because certainly eye discomfort, eye fatigue, decreased safety and associated factors are also costly, even though they cannot at present be appraised in terms of dollars wasted.

In the most recent investigation of the series which has been developing over many years, P. W. Cobb and F. K. Moss[2] used nine subjects who supplied 90,000 observations. The technique and method are the results of years of devotion to the field and are scientifically approved. The glare source was a 100-watt, inside-frosted "Mazda" lamp at various angles with the line of vision. Its distance from the eyes was constant and it produced an intensity of illumination of 5 foot-candles at the eyes in all cases. From these data various facts which have been only vaguely known are now determined quantitatively. Besides these, it has been found that the effect of a constant glare condition is to waste approximately the same percentage of light over the entire practical range of illumination levels up to 116 foot-candles—the extent of the investigation.

The percentages of the light wasted (as measured by reduced ability to see) for various angles of the glare source with the line of vision are found to be approximately as follows:

At 5 deg.	85 per cent of light wasted
At 10 deg.	73 per cent of light wasted
At 20 deg.	60 per cent of light wasted
At 40 deg.	48 per cent of light wasted
No glare present	0 per cent of light wasted

For example, for the glare source only 5 deg. from the line of vision, 10 foot-candles is visually equivalent to 1.5 foot-candles and 100 foot-candles is visually equivalent to 15 foot-candles. Even when the glare source is 40 deg. from the direct line of vision 10 foot-candles is visually equivalent to about 5 foot-candles and 100 foot-candles is only as effective as about 50 foot-candles. These results were obtained for what we term borderline vision; that is, for contrasts and size of test

[1] *"Glare and Visibility," M. Luckiesh and L. L. Holladay, Transactions I.E.S., 20, 1925, page 221.*

[2] *"Glare and the Four Fundamental Factors in Vision," P. W. Cobb and F. K. Moss; presented at I.E.S. convention, September, 1928.*

object such that they were seen with only 50 per cent certainty.

Much has been said about glare without fully awakening the user of light. Certainly with these quantitative data now available, which put the matter so clearly in terms of cost in foot-candles and, therefore, in dollars, employers will be more concerned with the evils of glare.

Measured in several ways, the effect of glare is found to be greater at the lower levels of illumination. However, when measured in terms of waste of foot-candles the cost of glare due to reduced ability to see is absolutely much more at high levels of illumination even though the absolute magnitude of the glare source is maintained constant.

These results are startling and should do much to produce a glare-consciousness in the work-world.

Developing Industrial Heating Prospects

ALL industrial customers of the Great Western Power Company of California will receive an information blank asking certain questions with a personal letter from one of the executives of the company calling the customers' attention to the facilities which the company's industrial engineers have to offer in connection with industrial heating applications. Customers will be invited to fill in the blank indicating the type of installation they are interested in. An industrial heating engineer has previously made the acquaintance of the individual to whom the letter is addressed and the blank is intended more as a follow-up for the recording of information to be placed on file or for other disposition.

Information Blank for Industrial Heat Applications

Heating Air

Size of space.....ft. long.....ft. wide.....ft. high. General construction.....No. of windows, doors.....Or openings .....Original temperature of space.....degrees Fahrenheit. Required temperature.....degree Fahrenheit. How quickly must required temperature be reached?.....Is automatic control required?.....Voltage available.....A.C.?.....Phase—1, 2 or 3?.....Cycle.....D.C.?.....If air blast, how many cubic feet per minute?.....

Heating Fluids

State if water, oil, chemical or solution—and nature..... Specific heat, if known.....Is container made of wood or metal?.....Capacity in gallons.....Thickness of walls..... Approximate weight of container.....Size of container..... ft. long.....ft. wide.....ft. high. (If round).....diameter .....depth. Original temperature of fluid when heat is turned on.....degrees Fahrenheit. Required temperature.....degrees Fahrenheit. How quickly must required temperature be reached? .....Is fluid circulating or in storage?.....Is automatic temperature control required?.....Voltage available.....A.C.?..... Phase—1, 2 or 3?.....Cycle.....D.C.?.....If process work, state kind, quantity, and temperature rise of material passing through fluid per hour.....

Heating Solids

State if metal, compound, grease, etc.....Number of pounds to be heated?.....Is container made of wood or metal?.....Thickness of walls.....Approximate weight of container.....Size of container.....ft. long.....ft. wide....ft. deep. If round..... diameter.....depth. Original temperature of solids when heat is turned on.....degrees Fahrenheit. Required temperature..... degrees Fahrenheit. How quickly must material be heated?..... Is automatic temperature control required?.....Voltage available.....A.C.?.....Phase—1, 2 or 3?.....Cycle.....D.C.? .....If process work, state kind, quantity, and how quickly, material is passing through heated chamber.....

Melting Solids

State kind of material to be melted.....Number of pounds to be melted.....degree Fahrenheh. How quickly must material be melted?.....How much cold material per hour is added?.....pounds. How accurately must temperature be regulated?.....Voltage available....A.C.?.....Phase—1, 2 or 3?.. ....Cycle.....D.C?.....Name of Company.....Street..... City and State.....Signed.....Position.....

On the front side of the blank is space for specific data as to heating processes, kind of material, size and character of present heating devices, temperature, regulation required, etc. On the reverse side is a detailed list of electric heating applications.

Development of Farm Loads

ACCORDING to a recent bulletin of Iowa State College the three farm lines which have served as a field laboratory for the Iowa Project on Rural Electrification were energized during 1920 and for a time used a flat rate for purchase of energy. The records of energy consumption started in 1921, when the farmers contracted to purchase energy at wholesale, the individual farm service was metered and bills were rendered by the company of incorporated farmers.

The eleven co-operating farmers used more energy than the other farmers before the beginning of the project. The curve shows how service can be developed on a farm providing it is well equipped. Since 1925 these eleven farmers have increased their service from two to ten times that used by the non-co-operators. The average use of electricity by these co-operators is comparable to a well-developed farm line where the rate is conducive to the use of service and the farmers have been given aid in developing their use and equipment.

Average consumption of farm customers in Iowa rural electrification project

The use of electricity on the 50 non-co-operating farms has been gradually increasing for the past six years until the individual monthly average is now about 40 kw.-hr. During this period the farmers were given no special encouragement and the increase of energy consumption indicates what may be expected of similar rural service lines.

Utility Offices May Become Commercial Laboratories

IN REMODELING its general offices the Worcester Electric Light Company has taken advantage of recent improvements in electric service to mercantile buildings to such a degree that the organization's official home might well be called a commercial and public relations laboratory. In its major appointments the building contains the usual facilities for the convenient transaction of business and for the comfort of employees. If this were all, no comment would be warranted, but in this case the effective utilization of the establishment by the public and the company from various angles has been studied for more than a year by the executives and an

engineer assigned to the betterment task and the result is significant.

Management, sales and accounting work are the chief activities at this downtown place of business. An electric shop, refrigeration display, lecture room for popular demonstrations of electric cooking, etc., employees' auditorium and welfare accommodations are provided. These facilities, with the routine business handled from hour to hour, afford opportunities to install and demonstrate many worth-while electrical applications. From the underground transformer vault serving the building to the radio speaker outlet in the auditorium the appointments have been designed and placed with the dual objective of combining use with commercial demonstration.

The wiring system, including many special features to assure flexible service, has been arranged to enable electrical contractors to study various details of interest to them in connection with interior installations. The illumination of every department, from the entrance lobby to the president's desk, has received close consideration and constitutes an exhibit of modern practice not likely to be lost upon the visiting customer. Refinements in bulletin, hallway and stairway lighting have been adopted to illustrate the latest resources of the art. Automatic door control switches, special gang switches for thin partitions, various uses of pilot lighting, facilities for electric cooking, supplementary room heating, comprehensive internal signaling systems, motor-driven office appliances, ventilation, cooling and other services have been provided to illustrate the diversity of electrical service today necessary in a well-equipped mercantile house.

In effect, the company has taken its own prescriptions for a healthy business. Numerous other power companies have doubtless done as well as Worcester in these directions, but the case in point is a specially good example of what can be done with an old building to give it a subtle sales appeal throughout and to create an atmosphere of cordial public and employee relations.

Letters from Our Readers

Investment to Serve Railroads

To the Editor of the ELECTRICAL WORLD:

I noticed in your article in the ELECTRICAL WORLD of Dec. 8 on the "Significance of Pennsylvania Electrification" that you made a statement on page 1134 that the investment of the power company for the railroad may be as high as $300 per kilovolt-ampere.

In many cases the total capital cost per kilovolt-ampere to serve the entire commercial and domestic load is of the order of $400 per kilovolt-ampere. The average system investment is very much higher than the investment required to serve individual large customers, a large portion of the average investment per kilovolt-ampere being in the widespread distribution mains and transforming facilities to serve the small industrial, commercial and household customer.

My feeling in this matter is that the investment of the electric companies to serve the railroad would more nearly be of the order of from $140 to $150 per kilovolt-ampere than the $300 which you stated in your article.

My only thought in calling this matter to your attention is that a figure of this kind, published by so well recognized a publication as the ELECTRICAL WORLD, may cause some of the power companies to feel the electrification of railroads, so far as they are concerned, is almost out of the question. And, likewise, may lead some of the railroad companies to believe it is very much better for them to consider the production of their own power than to buy it from the public service companies.

The entire tone of your article, however, indicates, on the average, that the railroad company will be better off by buying its power requirements from the electric service companies, and it would therefore seem that attention should be called to the fact that the figure given in your article is probably the extreme outside figure that could possibly occur.

N. E. FUNK,
Assistant General Manager.
The Philadelphia Electric Company.

Hydrogen Filled Rotary

To the Editor of the ELECTRICAL WORLD:

Referring to the article "Outdoor Nitrogen-Cooled Rotary Condenser" in the Dec. 1 issue of the ELECTRICAL WORLD, please note that this condenser operates in hydrogen and not nitrogen. The primary advantages of operation in hydrogen are the reduction in friction losses and reduction in heating, as compared with operation in air. These results would not be obtained with nitrogen, as air is composed of about four-fifths nitrogen and one-fifth oxygen.

H. R. SUMMERHAYES,
General Electric Company, Schenectady, N. Y. Engineer Central Station Department.

Quick Check for Three-Phase, Two-Meter Measurements

To the Editor of the ELECTRICAL WORLD:

My attention has been drawn to an article in the ELECTRICAL WORLD, Vol. 92, No. 5, which is headed "Quick Check for Three-phase, Two-Meter Measurements, and submitted by E. E. Kimberly of Ohio State University. Upon checking this test I find that Mr. Kimberly's statement is correct for leading power factors, but is incorrect for lagging power factors.

If, however, a similar change is made to the potential lead of the high reading meter, the same results will be obtained for lagging power factors.

It might also be of interest to note that if both meters are reconnected in the manner described by Mr. Kimberly the sum of the readings will give the correct three-phase power for balanced loads only.

J. H. BROWNE,
Canadian Westinghouse Company, Ltd., Montreal, Que., Canada. Service Department.

Mr. Kimberly, to whom Mr. Browne's letter referred, points out that the article to which he refers is concerned with the use of single-phase indicating wattmeters for measuring the power in a three-phase circuit and not to watt-hour meters for integrating the energy consumed. It is assumed, in connecting the two indicating meters, that a reading is obtained on both. The problem is to discover whether the indication of the lower reading instrument should be added to, or subtracted from, the higher indication to arrive at the true power in the three-phase circuit; that is, whether the power factor is above or below 50 per cent. If the potential lead of the low-reading meter which is on the middle phase wire, that is, the conductor not passing through either meter, is removed therefrom and temporarily connected to the third phase wire this meter will give a reading if the power factor is above 50 per cent and will not read if the power factor is below 50 per cent. As the power factor is thus shown to be above or below 50 per cent the indication of the low-reading instrument will be positive (additive) or negative (subtractive) with respect to the indication of the other meter.—EDITOR.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Forecasting Annual Run-off.—JOHN F. PARTRIDGE. — In hydro-electric developments where irrigation and power considerations constitute substantially a single problem the determination of the run-off to be expected seasonally from a given drainage basin has an exceedingly important bearing upon the utilization of the facilities. The author has prepared an investigation of the methods of estimating probable conditions and has emphasized the importance of the various factors involved. These include general topography, geology and hydrology of the drainage basins involved, the relationship between run-off and precipitation and the measurements made in snow surveys. The latter includes the measurement of total snowfalls, unmelted depth on the ground and density thereof at fixed stations or snow stations and the measurement of unmelted depth and density thereof over fixed courses so that the average conditions are represented. The results of specific surveys and determinations have been pointed out in connection with this exposition of an important feature of hydro-electric work.—*Electrical West*, Dec. 1, 1928.

New Power Stations and Extensions.—A number of new stations have been constructed in Great Britain in the past two years and additions to others of earlier construction have been made. This article offers a résumé of the tendencies indicated in modern design of British stations and gives specific details regarding the equipment and arrangement of apparatus in four or five of the more prominent developments.—*Electrician (England)*, Dec. 7, 1928.

Generation, Control, Switching and Protection

Lightning Voltage as a Factor in System Design.—A. L. ATHERTON.—The trends in system design, in so far as decentralized arrester installations, elimination of terminal stations, proper line location and joint design of system insulation and lightning protection are concerned, have been pointed out by the author. This discussion, while not highly technical, reviews some of the fundamental factors which have influenced present tendencies.—*Electrical West*, Dec. 1, 1928.

Overload Protection.—S. B. WARDER.—A comparison of the four principal systems of overload protection at present in vogue with some notes upon characteristics not generally apparent. It is the contention of the author that the problem of providing overload protection for a circuit is complicated by important differences in the inherent characteristics of each method and the variations in their application. The systems referred to in this discussion are: Instantaneous overload protection, inverse time overload protection, definite time overload protection and inverse and definite overload protection. An analysis of each of these groups has been made and characteristic curves illustrative of the performance which may be expected have been included. The author has made certain recommendations in regard to the application of the several methods for specific classes of work.—*Electrical Review (England)*, Nov. 9, 1928.

Units, Measurements and Instruments

Cathode Ray Oscillograph.—K. BERGER. — While this inertialess oscillograph is an excellent instrument to record and to measure even the fastest known electrical phenomena, great difficulties are encountered when transients are to be investigated, the time of occurrence of which is unknown, such as lightning discharges and their secondary actions. To be suited for this purpose the cathode ray tube itself must be designed sufficiently strong to allow hours of excitation without overheating and must have some deflecting device to keep the recording ray off the photographic emulsion until the actual disturbance occurs. These two requirements are solved by Gabor, whose deflector acts within about one microsecond. The writer describes an improved ray deflector and film drum, the latter containing sufficient film to make 300 exposures, each 4 x 6 in. in size, requiring about 100 ft. of film. An exceedingly clean-cut record of an overvoltage on a transmission line, caused by a nearby lightning discharge, is shown as an example of the performance of this new apparatus.—*Bulletin de l'Association Suisse des Electriciens*, Nov. 5, 1928.

A Study on the Design of Induction Watt-Hour Meters.—SEIKICHI JIMBO.—The basic principles and material limitations involved in the construction and design of watt-hour meters have been considered by the author. The driving torque and the retarding torque have been investigated theoretically on the supposition that the magnetic fluxes are uniformly distributed within the boundary circles. A consideration of the geometrical constants involved has been undertaken and general principles established for the simplification of the calculation of torque. Theoretical and experimental studies have been treated separately, but have paralleled each other closely. Load characteristics and temperature equations and analyses have been included in this discussion.—No. 235 *Researches of the Electrotechnical Laboratory of Japan.*

Transmission, Substations and Distribution

Flashing of Synchronous Converters.—T. P. HAMILTON and B. L. ROBERTSON.—A critical investigation of the factors which influence the behavior of synchronous converters with respect to flashing at the commutators with particular reference to preventive measures. The elements of the problem, relation of load upon the tendency to flash over and effect of armature reaction, frequency and voltage have likewise been considered. Oscillographic records and photographs have been used to substantiate the arguments and contentions advanced in this connection. The authors state that the formation of a complete arc between brush groups may be prevented by directing a current of air axially across the commutator surface from the armature toward the outer end of the commutator between each group of brushes. This current of air will twist the arc off the commutator before it can form a complete path between brush groups. The air blast may be provided either by a separate blower or fan furnishing air to an inclosure about the armature from which the air issues to a circular opening at the end of the commutator, or a fan that forms an integral part of the armature may be used.—*General Electric Review*, December, 1928.

Illumination

Effective Methods for Bank Lighting.—J. L. STAIR.—The application of modern lighting practices to the many varied requirements of banking institutions has been covered in a careful analysis by the author. The important changes which have of late years been made in the design of the bank as a building and the necessary accompanying variations in lighting work for such institutions have been pointed out. New uses for light and new methods of illumination are discussed in connection with examples of practical lighting in the main banking room, tellers' cages, office areas, vaults, coin rooms, and other locations. Particular attention has been devoted to the value of light for advertising and for artistic effect.—*Transactions of the Illuminating Engineering Society*, November, 1928.

Brightness of Street Surface as an Element of Effectiveness in Street Lighting. — PRESTON S. MILLAR. — In most street lighting as practiced the brightness of the street surface is an important factor in contributing to excellence of the result. Since most street surfaces are more or less specular, the problem of securing the satisfactory distribution of brightness over the street surface is largely a matter of placement of light sources. Some char-

acteristic brightness effects are illustrated in the discussion and the importance of giving due consideration to brightness in street lighting design is stressed. The author has concluded that discernment on the street at night is principally through perception of contrasts of brightness, objects offering extreme contrasts are likely to be seen by reflection of light from their surfaces, objects which do not offer extreme contrasts may be seen by light reflected from their surfaces if the illumination intensity is relatively high, most street lighting is not of high intensity, most objects on the street are seen as silhouettes, and irregularities in the street surface are usually perceived as a matter of contrast.—*Transactions of the Illuminating Engineering Society*, November, 1928.

Motors and Control

Selection of Motor Equipment by Principle of Similar Speed - Time Curves.—BERNDT A. WIDELL, JR.—Data for making preliminary estimates of motor speed requirements for railway service and of capacities of motors for a given duty have been rather limited, according to the author, and in this discussion a method is presented whereby it is possible to provide curves which are easy to calculate and apply. No mathematical formula has ever been derived to express the speed-time or current-time curves for a railway motor, according to the author, and the similarity between speed-time curves has been resorted to as a useful expedient. What is said to be a very accurate method involving consideration of the various factors which influence the shape of the speed-time curve has been expounded. While previous methods for estimating motor capacities are based on the horsepower of motor required, the advent of the self-ventilated and blown motors has made it necessary to calculate the r.m.s. current for a given cycle and select a motor having this continuous rating. The limiting values of average running speeds for given rates of acceleration and braking and the data for obtaining motor capacity necessary at these limits are indicated on each of the curves accompanying the discussion.—*Journal of the American Institute of Electrical Engineers*, December, 1928.

Heat Applications and Material Handling

Economic Aspects of the Shipment of Materials on Skid Platforms.—C. B. CROCKETT.—An exposition of the economies that may be effected in the coordinated handling of materials in industrial work through the planned utilization of skids for the transfer of materials between processes. The low-level electric truck is particularly adapted to this service and the possibilities have been fully indicated by the author.—*Mechanical Engineering*, December, 1928.

The Case Hardening of Steels by Nitrogen.—A description of the recently instituted process for the case hardening of steel by the action of nitrogen. The parts to be nitrated are placed in a gas-tight box of special heat-resistant steel, provided with inlet and outlet tubes for the circulation of the ammonia gas. The parts are loosely placed in the box without any packing material, the individual layers being separated by nickel wire netting to allow free circulation of the gas. The box is then put into the electric furnace and brought up to a temperature of 932 deg. F. The ammonia is supplied direct from cylinders. The case obtained by nitration is said to be much harder than anything previously known in the case hardening field. It will, according to this article, cut glass and even quartz; it cannot be touched with special testing files. Brinell figures converted from readings with other instruments are 900 to 1,100, and with Shore scleroscope readings of 102 to 113. The resistance to wear is said to be very great, amounting, as indicated in tabulated data, to at least ten times that of cemented and quenched steel.—*Engineer (England)*, Dec. 7, 1928.

Electrophysics, Electrochemistry and Batteries

Insulating Varnishes.—A. R. DUNTON and A. W. MUIR.—A careful analysis of the various types of insulating varnishes and of their dielectric and service characteristics indicates an unfortunate lack of uniformity in specifications. The author has classified this insulating material according to characteristics and solvents, and recommended treatments for coils have been grouped according to requirements of service. The equipment necessary for the application of the varnish and for adequate drying has been described and certain recommendations included. —*Electrician (England)*, Nov. 30, 1928.

Insulating Materials.—A discussion of electrical insulation from the viewpoint of designers of machines and transformers and of the different stresses imposed by service conditions. The ability of a number of specified materials to withstand these stresses is considered, with due regard to recognized principles of design whereby known or anticipated stresses are suitably distributed. The author points out that the behavior of insulating material as used in the construction of machines and transformers is influenced by humidity of the air and geometrical form of the adjacent parts. It is said to be essential therefore to insure that test data and numerical results are always given in such form as to reveal the conditions under which the tests were conducted. A number of the variants entering into the situation have been considered with particular reference to the electric strength of compounds as a function of temperature.—*World Power (England)*, November, 1928.

Traction

The Automatic Rectifier Substations of the Dutch Railways.—A. DANZ.—The continually increasing volume of traffic on the lines of the Dutch Railways between the two most important towns of Holland reached such proportions that the steam traction system employed could no longer handle the requirements. The electrification program adopted included the construction of seven automatic rectifier substations located on the main line of the railways. The author has indicated the economic conditions which led to the specification of electric operation and has pointed out a number of the design and construction features employed. Operating procedures and safety precautions as well as efficiency data have been included. As a result of the experience obtained with the first installation it is expected that substations to be erected during the second phase of the electrification scheme will also be equipped with rectifiers and a promising future for this type of station on all railway electrification schemes of the future is foreseen.—*Brown Boveri Review (Switzerland)*, December, 1928.

Miscellaneous

Co-operation Between Electric Power Companies and Local Back-Steam Turbine Plants.—TORSTEN HOLMGREN.—Up to the present time it has been common practice abroad, particularly in rural districts, to equip large hospitals, hotels and similar establishments with isolated electric direct-current plants which are combined with the heating system by one or more back-steam engines or turbines and with a storage battery for peak load and low night load. Giving statistical curves and data for the variation of electric load in large hospitals during the daytime throughout the year and its relation to the demand for heat, the author points out that in countries with climates similar to that in Sweden it is now as a rule economically sound to build a local back-steam plant for alternating current and run it in parallel with a power company at a load corresponding to the demand for heat. Energy may be bought from the power company for day and night-time demand in summer and night-time demand in winter, and superfluous power is sold to the company in the winter days. Economies are realizable with such a plan as experience has proved. —*Svenska Elektricitetsverksföreningens Handlingar*, December, 1928.

State Laws Relating to Theft of Electric Current.—The meter committee of the National Electric Light Association has compiled information regarding laws pertaining to the theft of electric current. A summarization of revised statutes for each state in the United States and a citation of certain court and commission decisions has been added.—*Report National Electric Light Association*, November, 1928.

Book Reviews

Accounting Procedures for Public Utilities

By W. G. Bailey and D. E. Knowles. Chicago: A. W. Shaw Company. 471 pages, illustrated.

The publication recently issued under the above title should be of great practical value to the utilities. The treatise deals especially with electric light, gas, water and electric railway utilities. It covers in a thoroughgoing manner the usual subjects dealt with in works on accounting, but adds valuable interpretive discussion relating chiefly to capitalization and financial problems. A chapter is devoted to the very desirable end of the adoption of uniform accounting by the utilities. There is an interesting and informing chapter on budget procedure dealing at length with the construction and the financial budgets.

Electrical Engineering Laboratory Practice

By Oscar E. Edison and F. W. Norris. Boston: Ginn & Company. 276 pages.

This book covers a wide range of laboratory problems and experiments on conductors, instruments, direct-current motors, generators, alternating-current circuits, transformers, synchronous machinery, converters and induction motors. The authors prepared it because their experience indicated a lack of such material in the electrical engineering textbooks commonly used. Its clear-cut utilization of vector analysis is refreshing even to the active professional reader, and while primarily a textbook of major value in the college laboratory, the work contains many points of interest to the operating man.

Handbook of Domestic Oil Heating

American Oil Burner Association, New York, N. Y. 383 pages, fully illustrated. Price, $3.

In this new edition, the first revision of the association's handbook in two years, a definite and intelligent effort has been made to eliminate all obsolete material and include quantities of new data for which those at work in this fast-growing industry have felt a genuine need.

At the outset Henry F. Tapp, the editor, has carefully defined and explained the words, phrases and terms in heating and ventilating practice, in oil technology and in oil burning, so that even those most unfamiliar with these subjects will be able to read the book with understanding. This patient clarity of exposition is an outstanding feature of the whole book. Whether it is discussing radio "interference" and oil burner operation or describing and analyzing the different types of oil burners and controls, there are always near at hand a sufficient number of pictures and tables and charts to make the explanation quickly intelligible.

Not content with relating a history of the use of oil as fuel, the editor has assembled in quickly available form all of the facts about petroleum that may be of practical use—production figures, methods of recovery, distilling and refining, pumps and storage, and characteristics and properties of fuel oil. There is a detailed discussion of fuel oil combustion and the principles upon which modern oil heating equipment is built. A lengthy and particularly well-illustrated chapter is devoted to description and analysis of the different types of oil burners and controls.

Die Physikalischen Grundlagen der Elektrischen Festigkeitslehre

By N. Semenoff and A. Walther, Leningrad, Russia. Berlin: Julius Springer. 168 pages, 116 illustrations.

The book deals with a mathematical investigation of the dielectric properties and characters of air, vacuum and solid materials, based chiefly on original research work made by Soviet Russian professors in the federal laboratories at Leningrad. The first part gives detailed descriptions of experimental methods to measure electric fields and complex electrostatic problems. Of great value are the field computations on porcelain insulators, polyphase cables and cable joints. The second part is a thesis on the vacuum as an insulator, while the final third section investigates solid dielectric materials. The heat, ionization and mechanical theories of electric puncture are explained, and their validities are checked on a great many laboratory tests. The authors came to the conclusion that a puncture at high temperature is primarily a heat process, while at low temperature the ionization theory fits best actual conditions. But these theories seem to apply only to materials of crystalline structure. For other substances a number of secondary phenomena occur with the breakdown, such as chemical and thermal disturbances.

The American Way to Prosperity

By Gifford K. Simonds and John G. Thompson. Chicago: A. W. Shaw Company. 243 pages, illustrated. Price, $3.

A feature of merit of the "American Way to Prosperity" is its presentation of specific facts and figures dealing with the various branches of business rather than the use of vague generalities. It goes very thoroughly into the reasons why American labor with fewer hours of work receives considerably higher wages than those received anywhere else in the world, and at the same time with a steady increase in production. The authors delve into the secret of prosperity in this country in a manner which gives an illuminating picture of the leading factors of business success. They do not omit, incidentally, to point out that the added hours of leisure which all this makes possible involve spiritual as well as material values.

Der Phasenverschobene Strom

By Richard F. Falk. Berlin: Julius Springer. 92 pages, 52 diagrams.

To a much greater extent than in America, apparently, metering practice in Europe employs a variety of combinations of in-phase and out-of-phase current relations on which special rate structures are built. That practice has given rise to an array of types of meters scarcely known in this country. From the standpoint of present American usage a discussion of some of them is therefore of relatively slight interest, but as a survey of what has been accomplished and an analysis of possible methods, their objects and limitations, it should be of considerable value, especially to meter specialists. The title of the monograph under review suggests some sort of theoretical discussion of out-of-phase currents. The fact is that it is directed to a study of their measurement and of the reasons for taking them into account. In the light of American striving toward simplicity, even at the cost of rigorous justness, the final suggestions for suitably metering installations of various sizes deserve mention.

Book Notes

DONNÉES NUMÉRIQUES D'ELECTRICITÉ MAGNÉTISME ET ELECTROCHIMIE. Tables Annuelles de Constantes et Données numériques— Vol. VI. Paris: Gauthier-Villars & Cie. New York: McGraw-Hill Book Company.

The present assemblage comprises extracts from Vol. VI of the annually published tables of constants and numerical data issued by the International Union of Pure and Applied Chemistry. It should be of value particularly to physicists and to workers in electrical research laboratories.

FINDING AND STOPPING WASTE IN MODERN BOILER ROOMS. By the Cochrane Corporation, Philadelphia. Third edition, revised and enlarged. Price, $3.

This well-known reference manual has been revised and enlarged. It tells the owner, manager or operator of power stations about the equipment, controls and methods in use to secure and maintain boiler economy. It has good sections on fuels, combustion and boiler room equipment and is popular with many power plant men.

Books Received

Electric Drive Practice. By Gordon Fox. New York: McGraw-Hill Book Company. 421 pages, illustrated. Price, $3.50.

Vibration Problems in Engineering. By Timoshenko. New York: D. Van Nostrand. 348 pages, illustrated. Price, $4.50.

News of the Industry

Sees Five to Thirteen Million Saved

President Sloan of New York Companies Promises Commission a Reduction of Rates in That Amount if Practice of Submetering Shall Be Abandoned

PUBLIC interest as well as utility interest in the investigation into submetering now being carried on by the New York Public Service Commission as the outcome of an attempt by President M. S. Sloan of the united light and power companies of the metropolis to have the practice outlawed was augmented on Monday of this week when Mr. Sloan took the stand and promised an immediate reduction in electric power rates throughout the city of from $5,000,000 to $13,000,000 a year, on the condition that the electric submeter service be eliminated. On the contrary, if the submeter system persists, Mr. Sloan declared, the electric companies will be forced to apply to the Public Service Commission for permission to increase rates.

The New York Edison, the United Electric Light & Power, the Brooklyn Edison and the New York & Queens companies, Mr. Sloan said, sell through 10,154 master meters approximately 567,000,000 kw.-hr. at an average rate of 3.6 cents. "If the submeter companies charge their customers, as has been indicated by testimony in this case," he said, "approximately 2.6 cents a kilowatt-hour more than they pay us for this energy, the submetering companies charge their customers for electricity supplied by us $14,060,000 more than they pay us for this energy. In other words, if there were no middlemen in the situation, the users of electricity would get better service for $14,000,000 a year less than they now pay. Our retail and wholesale rates to our other customers are kept unduly high because these submetering concerns get this $14,000,000."

"Submetering companies," Mr. Sloan continued, "are unregulated middlemen purchasing an essential service, electricity, from state-regulated electric utilities and selling it to their customers at arbitrary prices and a substantial increase in price over what they pay our companies for the energy resold. . . . The principle is economically unsound and is unfair to our company, to our customers and to the customers of the submetering companies. No one can possibly receive any benefit from this system except the submetering companies. Customers of submetering companies having difficulties with their service are very likely to charge their troubles to our company, when it will not be our service which is at fault, the trouble usually arising in the house distribution system. Our companies maintain a 24-hour-a-day service department, at a great expense, to answer instantly trouble calls received from customers, and we often respond to calls and remedy service troubles of customers of the meter-service companies. As we visualize the operations of the submetering companies, if the practice is permitted to extend and grow, our companies will find themselves over a period of time exclusively in the wholesale business with the most profitable part of our retail business lost to the submetering companies."

Cross-examined by opposing counsel, Mr. Sloan, who admitted that in the past the New York Edison Company had fostered submetering, said: "We have no desire to confiscate any property. We will make restitution to the owners and will buy their equipment and will even make any other amends ordered by the commission."

At a hearing held on Thursday of last week submetering companies refused to produce their books if counsel for the public utility companies were to have an opportunity to examine them. Further prophecies of independent generating plants being installed by owners of buildings were made. The next hearing was to be on Friday, January 11.

Another Contest Threatened

A closely related fight may be waged with the company by owners of neighboring buildings which have in the past been served jointly but which by a newly filed amendment to the New York Edison rate schedule will in the future forfeit "conjunctive" service if they are separated by a street or highway. The Building Managers and Owners' Association of New York protests against this rule and says: "If the new rule becomes a law, many of our members who have private power plants and who shut them down in the past to obtain conjunctive service will reopen them and undoubtedly new power plants will be built."

New Jersey Courts Sustain Ouster of Master Meter

The Court of Errors and Appeals at Trenton, N. J., on January 3 vacated a stay, allowed November 30, under which the Public Service Electric & Gas Company was enjoined from removing a master meter from the apartment house in East Orange known as Sixty-Seven South Munn, Inc.

The action marks another step in the fight by which the apartment house owners have sought to compel the Public Service company to furnish energy at wholesale rates so that it could be resold at retail through the Meter Service Company to tenants in the apartments. Vice-Chancellor Church had granted a stay pending a decision on the question by the Board of Public Utility Commissioners. The board recently decided in favor of the company. Application then was made to Chief Justice Gummere for a writ of certiorari to review the board's order and this was refused.

The case is pending before the Court of Errors on an appeal from the refusal of Vice-Chancellor Church to grant a permanent injunction against removing the meter.

New York Edison Begins to Merchandise

In accordance with the radical change of policy reported in the ELECTRICAL WORLD for December 29 (page 1312), the selling of appliances to the public was begun by the New York Edison Company on January 2. Full details of merchandising methods remain, however, to be worked out. Speaking before the New York Electrical League at luncheon on January 9, President M. S. Sloan made these remarks:

We intend in future to sell electrical appliances at the showrooms of the New York Edison Company just as they are being sold by other companies in the system. . . . The thought behind the old situation was that the utility was interested only in the use of energy by its customers and that by refraining from selling appliances itself it left equal opportunity and an open field to all venders. As a matter of fact, it didn't work out that way, and you know it didn't as well as I do. All dealers and all contractors did not get equal advantages from this practice, and I doubt whether the company's refraining from actual sales of appliances was of real benefit to anybody. . . .

We shall not cut prices or do anything else, directly or indirectly, to place any contractor or dealer under unfair competition. We shall endeavor to stimulate this branch of our business by advertising as we do other branches of our business. I believe this advertising will be of such character as will result in sales of electrical merchandising not by us alone but also by others who carry such goods. If it does, we shall be glad to feel that our new course is of benefit and profit to others in the industry as well as to ourselves. Our interest as a public utility supplying electrical service is and always will remain primarily in the increased use of energy. Our efforts in merchandising of apparatus will be directed and shaped to that end. The more energy-using devices sold—whoever makes the sales—the more electricity will be used and the more value the public will get out of electric service.

At the Electrical League luncheon President Earl Whitehorne, Vice-Presidents T. H. Joseph, W. A. Kennedy and C. L. Law, Treasurer L. L. Strauss and Secretary D. T. Brown were re-elected for 1929. L. A. Coleman, Edward De Forest, G. T. Dunklin, E. P. Prezzano and Grant Armor were elected as directors for three years, Mr. Armor's being the only new name.

Organization of United Corporation Announced

J. P. Morgan, Drexel and Bonbright Companies Join to Acquire Certain Minority Interests in U. G. I., Public Service of New Jersey and Mohawk-Hudson

THE United Corporation has been organized under Delaware laws by J. P. Morgan & Company, Drexel & Company and Bonbright & Company, Incorporated, and has made arrangements to acquire certain minority interests in the United Gas Improvement Company, the Public Service Corporation of New Jersey and the Mohawk-Hudson Power Corporation held by the organizers and the American Superpower Corporation. The capitalization of the corporation is as follows:

	Authorized, Shares	*To Be Presently Issued, Shares*
First preferred stock	1,000,000 (no par value)	None
Preference stock	2,000,000	944,187
Common stock	*10,000,000	3,810,853

*Four million shares will be reserved against exercise of option warrants.

There will also be presently issued option warrants entitling holders to purchase at any time without limit not in excess of 4,000,000 shares of common stock at $27.50 per share.

The preference stock presently to be issued will be known as three-dollar cumulative preference stock, will be entitled to cumulative dividends at the rate of $3 per annum, payable quarterly; will be redeemable at the corporation's option at $55 per share, and will be entitled on liquidation to $50 per share and accrued dividends. Both common and preference shares, and, if and when issued, the first preferred stock, will have full voting powers.

There have been purchased by the organizers, for $20,000,000 cash, 800,000 shares of the common stock and option warrants for 2,000,000 shares of common stock. The balance to be presently issued of the common stock and option warrants and the 944,187 shares of three-dollar cumulative preference stock are to be issued in exchange for securities. The prices at which securities have been acquired by the corporation from the organizers are in excess of the cost to them, but below the present quoted market.

The corporation's present assets will consist of the securities described, which, on the basis of present market quotations, have an aggregate value in excess of $130,000,000, and cash in excess of $20,000,000. The balance of the authorized capital may, in the discretion of the directors of the corporation, be issued for cash or property without offering to the stockholders. The directors of the corporation will be Thomas S. Gates, Alfred L. Loomis, Landon K. Thorne and George Whitney.

American Superpower Corporation Announcement

The American Superpower Corporation announced that at a meeting of its board of directors held yesterday the board unanimously voted to accept the offer of the United Corporation to exchange its holdings of Public Service Corporation of New Jersey and the United Gas Improvement Company for securities of the United Corporation.

Belgian Decoration Bestowed on E. D. Adams

At a dinner held at the University Club, New York, on January 7, and attended by fifty of the leading engineers of the country the committee on the war memorial to American engineers erected in the tower of the library of the University of Louvain, Belgium, made its report. The carillon and clock, which were dedicated on July 4, 1928, cost, including the endowments, in excess of $80,000, and three thousand engineers contributed to the fund.

At the dinner Prince Albert de Ligne, Belgian Ambassador to the United States, presented to Edward Dean Adams, chairman of the war memorial committee, the insignia of Commander of the Belgian Order of the Crown. In making the presentation Prince de Ligne expressed the gratitude of King Albert and the people of Belgium both for the good-will of the donors and the choice of Louvain as the site of the memorial.

Roy Wright, president of the United Engineering Society, presided, and the set speech of the evening was made by William H. Onken, Jr., of the ELECTRICAL WORLD, who was one of the delegates of the American Institute of Electrical Engineers at the dedication. Mr. Onken's topic was "The Louvain Memorial and What It Suggests," and he praised the memorial and the spirit behind it as "one of the rare instances where engineers have departed from the cold intellectualism of pure and applied science to give expression to the loftier and nobler ideals of human activity and human sympathy."

League Men Hold Midwinter Meeting in Cleveland

Eighty-seven representatives of 37 local electrical leagues held in Cleveland this week the second midwinter conference of electrical league officers and managers. Meetings were held on Monday, Tuesday and Wednesday at the headquarters of the Cleveland Electrical League, R. Bourke Corcoran, chairman of the League Council, presiding. This is a working meeting held midway between the annual conferences at Camp Co-operation, for the purpose of discussing league problems and crystallizing policies for the guidance of local executives in the practical details of league work. The three outstanding themes under discussion were the problem of securing adequate wiring in new and old homes, the responsibility of the leagues to help make the contractor-dealer a better business man, and the opportunity offered by the industrial lighting field to the application of the Franklin specifications.

Tuesday afternoon was devoted to a visit to the National Lamp Works at Nela Park for a practical demonstration of the Franklin specifications in planning for industrial and commercial illumination. This theme was the outstanding interest of the meeting. H. L. Grant of the Graybar Electric Company addressed the conference on the responsibility of the leagues in trade relations, analyzing the work that is done in Cleveland to discourage destructive price competition among small contractors and the loose extension of credit by wholesalers.

Experiences in the recent Christmas outdoor decoration of lighting companies showed that intense public interest was aroused in many cities by the national prize offer and that outdoor lighting has taken its place as a winter league activity.

The committee of manufacturers that has been endeavoring to set up a co-operative basis of clearing subscriptions to leagues through a national pool, in accordance with the proficiency of the leagues, has recommended that manufacturers continue the previous method of subscribing for the first half of the year.

Electric Bond & Share Case Postponed by Court

A motion made at New York on January 8 by counsel for the Federal Trade Commission for an order requiring officers and accountants of the Electric Bond & Share Company to produce records and papers which the commission wants in its utility investigation but which the company asserts are not pertinent to it was postponed by Judge Thatcher because he was of counsel for the company before he was appointed to the bench. He put the motion over until February, when another judge will be sitting in the motion part of the court.

Power on the Columbia

Sites on Northwest River Are Attracting Renewed Attention, and Power Commission Has Application for 144,000-Hp. Development—A New Girand Project

THAT the time is approaching when it will be feasible to bring in some of the lower-cost water powers of the Columbia River is indicated by the attention sites on that river now are attracting. The Washington Electric Company of Seattle, understood to be backed by Stone & Webster, has just applied to the Federal Power Commission for a preliminary permit covering the important site 12 miles below Wenatchee, Wash., in the west channel of the Columbia near the lower end of Rock Island. The ultimate installation planned is 144,000 kw. In addition to the Washington Electric Company project, Hugh L. Cooper, as already reported, is planning a large development at "Z" Canyon and another company is planning to harness Kettle Falls. No one of these projects will interfere with the eventual irrigation of the Columbia basin. Development of the Columbia was suspended for some time pending a study of the irrigation project. The Department of the Interior finally came to the conclusion that several decades must pass before irrigation was likely to be undertaken.

James Girand of Phoenix, Ariz., who a few years ago all but secured a license for a development at Diamond Creek on the Colorado River, has applied to the Federal Power Commission for a license covering a 6,000-hp. development on Salt River in Gila County. Salt River is a tributary of the Gila. The Gila and its tributaries were released by the Boulder Dam act from the ban against the granting of any water-power rights in the Colorado basin. The site of the Salt River project is that used for power development during the construction of the Roosevelt Dam. The power is to be used for mining purposes at the copper properties in southern Arizona. The fact that these companies are ready to develop their own power is thought to be a precaution based on possible delay in Boulder Dam.

Penn-Ohio 1929 Improvements to Cost $5,000,000

More than $5,000,000 of new capital will be expended by the Penn-Ohio System in 1929 in adding to its facilities. At its Toronto (Ohio) power station, in which a fourth 37,500-kva. turbo-generator was placed late last year, boilers and auxiliary equipment will be installed; the building of a major transmission line will complete the power loop for the Youngstown and Sharon districts, and the erection of substations and the increase of capacity of existing substations, with extension of service lines, both in city and rural sections, will bring to every district served by the system in Ohio and Pennsylvania a share in the improvements.

An undertaking of importance will be the building of a transmission line from the Salt Springs substation, west of Youngstown, to Masury, Ohio, where a substation of 37,500 kva. rating will be erected. Work of erecting the steel towers for this line on a right-of-way obtained last year will begin soon. The capacity of the present circuits to Masury from Lowellville will be increased. With this work completed the line capacity to the Sharon industrial district will be approximately tripled, while a power loop will be completed serving both the Sharon and Youngstown districts from either direction.

Other improvements will be the completion of the North Avenue substation at Youngstown, increase of capacity of distribution stations there and improvements in the distribution facilities in various parts of the city. More than $200,000 will be expended in the Girard district, additional distribution facilities will be provided throughout the Columbiana district, upward of half a million dollars will be spent in the New Castle district, all in Ohio, and about $600,000 will be expended in the Harmony district south of Ellwood City, Pa.

Commission Cuts Rates of Alabama Power

Forces 20 per Cent Reduction in Company's Price for 5 Kw.-Hr.—Company Urges Increase in Consumption to Obviate Necessity of Appeal

AN ORDER requiring the Alabama Power Company to put into immediate effect a new classification of domestic service rates which will reduce the company's annual revenue by approximately $300,000 was issued on Jan. 1 by the Alabama Public Service Commission. The company recently applied to the commission for approval of a new standard schedule of domestic and commercial rates, but protests from consumers who declared that these rates would increase many bills prompted the commission to revise the schedule.

The schedule ordered by the commission, to go into effect in February, differs from that filed by the power company in that the charge for 5 kw.-hr. was reduced from $1 to 80 cents. Under the new standard rates a customer occupying a three-room house and using only 20 kw.-hr. per month will pay $1.55 as against $1.80 under the existing rates. The order further specifies that all who were customers at the time the order was issued shall have a period of 45 days from the date of their first bills to elect to return to the schedule previously applicable. According to the commission's deductions about 92 per cent of the domestic consumers will have their bills reduced while 8 per cent will have theirs increased.

Upon the issuance of the order by the commission, Eugene Yates, vice-president and general manager of the Alabama Power Company, made the following statement:

We have studied the order of the Public Service Commission fixing reduced electric rates for residential service in Alabama. The effect of these rates on the net revenues from this class of business is a very radical rate adjustment. The new rates will cut the revenues of this company about three times the amount originally proposed.

We are very hopeful that the result of putting this new rate into effect will be a larger use of labor-saving devices in the home, and we shall do everything in our power to acquaint the public with the value of electric service and the advantages offered to them by the extremely low rates prescribed by the commission.

It is certainly our hope that the company will not be forced to appeal from this order of the commission and that the future months will show that our customers are appreciative of these low rates and have taken advantage of the opportunity they offer them for more complete electrification of their homes, to their own betterment and convenience. The extent of its recognition by our customers will largely control whether or not this is to be a permanent rate situation.

New Rate Schedule of Duke Power Company

New schedules of power rates recently adopted by the Duke Power Company are, like that company's previous rates, notable for their simplicity and absence of qualifying clauses. There are eleven schedules, divided according to the diverse industries served, according to whether primary or secondary power is supplied, and according to whether 100 kw. and more is used or whether less than 100 kw. is used. Schedule No. 1 is representative. It is for primary day or night (or day and night) power for textile and grain mills using 100 kw. and over. The initial charge is 1.40 cents per kilowatt-hour for the first 25,000 kw.-hr. a month; the next 25,000 kw.-hr. is supplied at 1.38 cents; next 50,000, 1.33 cents; next 50,000, 1.30 cents; next 50,000, 1.22 cents; next 100,000, 1.13 cents; next 500,000, 0.9 cent; next 700,000, 0.87½ cent; all over 1,500,000, 0.85 cent.

Hartford May Develop Power from Projected Reservoir

A project is afoot in Connecticut by which the Hartford Water Board is seeking the right of eminent domain in order to develop a domestic water supply on the East Branch of the Farmington River, combining the extension of the city's water facilities with a possible hydro-electric plant of approximately 5,000 kw. maximum rating. The matter must be favorably acted upon by the Board of Aldermen prior to obtaining legislation authorizing the construction and necessary land takings. Notwithstanding newspaper reports, the project is as yet in its earliest stages, and while the Hartford Electric Light Company has signified its willingness to co-operate if the city is allowed to build the reservoir and sell power from the head thereby created, it is unlikely that the development will materialize for several years.

In the Legislative Mill

Power Development and Utility Control Occupy Lawmakers' Attention in Various States — Similar Questions Reported from Provincial Capitals in Canada

NO FURTHER development of importance concerning legislative action on potential water power in the St. Lawrence or any other stream had evolved in New York State up to Thursday noon of this week. Two concurrent resolutions bearing on utilities were, however, introduced in the Assembly by Democratic members.

Assemblyman Post of Manhattan asked for a legislative committee to investigate reports of a general merger of light and power companies from Canada to Pennsylvania through the agency of a holding corporation and Assemblyman Reidy of the Bronx sponsored a resolution for an investigation into charges alleged to have been made at hearings of the Federal Power Commission to the effect that from $28,000,000 to $38,000,000 had been spent in New York by power corporations in advertising and spreading of private ownership propaganda through school channels.

Abraham Grenthal, Republican, of New York City, has introduced a bill in the Assembly amending the Public Service Commission law by bringing under the commission's jurisdiction persons or corporations selling or reselling through private meters electricity generated or sold by any other person or corporation.

The New York State Conference of Mayors and Officials of First-Class Villages, among other things, recommends to the Legislature and the Governor the enactment of permissive legislation which will give to the municipalities "the right to acquire, construct, own, lease and operate within or without their corporate limits any public utility, product or service which is or is to be supplied to the municipality or its inhabitants, or to enter into contract for such product or service." The conference also favors the state development of undeveloped hydro-electric power.

Governor Gardiner in his inaugural address to the Maine Legislature last week recommended the "divorcing" of the subject of water power from politics. The new Governor called upon the members of the Legislature to "still the voices that are raised in attempts to subvert economic affairs to political ends." Although there is no certainty that the matter will be brought up at this session, a fact-finding committee of the Maine Development Commission, with the aid of a committee from the State Grange, is at work on a survey. The report will be placed before the lawmakers some time in February.

A franchise tax on electric utilities is recommended by a special commission reporting to the New Hampshire Legislature. Says the report: "We cannot reach the value of the rights granted in the franchises by any of the methods used in taxing tangible property." The tangible properties of these utilities are taxed in their respective communities. But the development of the utilities is rapid and the franchises are held to be of high value. This tax is said to be designed to cope with the situation created by the exploitation of the state's water powers.

A bill to repeal the Pence law, which permits public utilities of Ohio to collect increased rates under bond before they are approved by the utilities commission, was placed before the Legislature at its first session this week. The bill, introduced by Representative Summers of Oberlin, provides that no new rate can be put into effect by a utility until formerly approved by the utilities commission or by ordinance of a municipality. Repeal of the Pence law was one of the issues raised by Myers Y. Cooper in his campaign for Governor, and it is believed that the Legislature, which is strongly Republican, will accede to the wishes of the chief executive.

The Missouri State Tax Commission is preparing a bill designed to obtain independent support for the Missouri Public Service Commission by levying a tax of one-fifth of 1 per cent on the gross revenues of the public utilities that come under the jurisdiction and supervision of the commission. The measure will be submitted to the Missouri General Assembly, now in session at Jefferson City.

Representative Roth of Bellingham, Wash., will introduce a bill in the Legislature of that state asking for an appropriation for a valuation survey of all the properties of the Puget Sound Power & Light Company in the commonwealth. The work would be done under the supervision of the State Department of Public Works.

Power production and utility control also play a prominent part in some Canadian legislatures. In the Province of Saskatchewan wide authority to manufacture, distribute and sell electricity is conferred on a new Saskatchewan Power Commission by the terms of a bill now before the Legislature. This is in pursuance of the government's policy. The bill creates a body of from one to three members, and its supporters envisage a unified and province-wide system requiring an original capital investment of $5,500,000.

In British Columbia the Union of Municipalities is sponsoring a definite demand for the creation of a public utilities commission in that province. Three matters have recently intensified the agitation for such a body—first, the sale of the British Columbia Electric Railway Company, with an increase in capitalization; second, a dispute between the West Kootenay Power Company and some of its chief customers, and, third, a clash between the Victoria city authorities and the British Columbia Electric Railway Company over power rates, with the city threatening to develop its own power. Another point is a recent enlargement of Vancouver.

Purchases and Mergers

Southern Ohio Public Service Company Absorbed by American Gas & Electric—Bids for Watertown (S. D.) and Rochelle (Ill.) Municipal Plants

PURCHASE of the Southern Ohio Public Service Company of Zanesville, formerly controlled by Day & Zimmermann, which furnishes power to about 300 central Ohio communities, by the American Gas & Electric Company of New York was announced January 7. The purchase includes all property and holdings of the Ohio company. The amount involved in the deal was not made public, but it was understood to have been several millions of dollars. The service company will continue to operate under the same name with E. T. Wagenhals of Newark, Ohio, as supervisor.

An offer of $500,000 for the Watertown (S. D.) municipal light and power plant and distribution system has been made by the Northwestern Public Service Company to the City Council. A tentative 20-year franchise ordinance also was submitted. It would be necessary to obtain the consent of the voters before the plant could be sold, and a ballot on the matter may be taken in the near future.

The Illinois Northern Utilities, which last spring offered $250,000 for the Rochelle (Ill.) municipal electric plant, has raised its bid to $650,000, but the Mayor has indicated that no action will be taken until the city investigates its ability to finance an enlargement of the plant and the requirements of local industries. The Federal Public Service Company, Chicago, is also interested in the acquisition of the utilities.

The Genesee Valley Power Company, with headquarters at Fillmore, N. Y., lost its identity as an independent company on January 1, when full control of the company passed into the hands of the Rochester Gas & Electric Corporation. The company was organized 22 years ago by Wilson L. Young.

Conveyance to the Georgia Power Company of the electric and gas properties of the Mutual Light & Water Company, serving Brunswick, Darien, Ridgeville and St. Simon's Island, has just been announced by P. S. Arkwright, president of the Georgia Power Company.

The People's Light & Power Company of New York has bought the Eastern Minnesota Power Company of Pine City. The Eastern Minnesota Power Company was established more than twenty years ago and supplies power to thirty or more communities.

The citizens of Warroad, Minn., have voted to sell their electric light plant to the Electric Construction Company of Grand Forks, N. D. Warroad will receive high-line service.

The American & Foreign Power Company has made an offer of $125 a share for the 100,000 outstanding shares of the Northern Mexico Power & Development Company, Ltd. Concessions have been granted to this company by the government of Mexico for the development and utilization of the water power of the Rio Conchos in the State of Chihuahua and to supply electrical energy to cities, towns and mining districts in that state. The company is now owned by English and Canadian interests, with the head office in Toronto.

North Central Association's Engineering Conference

After Chairman J. A. Colvin has outlined the coming year's program for the Engineering Section of the North Central Electric Association and Secretary John Lapham has reported, at the conference to be held in the Nicollet Hotel, Minneapolis, on Monday, January 21, there will be a number of addresses.

Talks included are by C. J. Strike of Huron, S. D., on how operating and commercial departments can co-ordinate their activities; by T. D. Crocker, Minneapolis, on the value of the Engineering Section to operating companies; by W. C. Hahn, General Electric Company (at luncheon), on the use of the calculating table; by Major H. S. Bennion of the N.E.L.A. on interstate power; by E. H. Morris, chief engineer North Dakota Railroad Commission, on service problems from the commission's standpoint; by E. C. Stone, chairman N.E.L.A. Engineering National Section, on engineering in the power industry, and by W. H. Frost of Huron on operating budgets. L. M. Pharis, chairman of the association, and L. W. W. Morrow, editor ELECTRICAL WORLD, will speak at the banquet to be held in the evening.

On Tuesday committee and group meetings will occupy the day, with a luncheon address by A. C. Montieth of the Westinghouse company on recent developments in electrical apparatus. A trip to the airport at 4 p.m. will be followed by an air trip over the Twin Cities.

Tennessee Electric Power's Budget for 1929

The Tennessee Electric Power Company and its subsidiaries will expend approximately $5,000,000 on new construction work during 1929, according to Vice-President J. C. Guild, Jr. As in former years, the greater portion of the budget is for power and lighting, on which a total of about $4,500,000 is to be spent.

Forty-four miles of high-voltage steel-tower transmission line from Nashville to Centerville will be erected, a transformer station will be installed at Centerville, and 44,000-volt lines will run north and south to McEwen and Hohenwald to supply communities now dependent on small isolated plants. From Hohenwald the line will run to the Lewis-Wayne county line. Much new auxiliary equipment will be installed in generating plants and substations.

Institute Promises Fine Winter Program

Cables, Transmission, Lightning, Protective Devices, Induction Motors and Measurements Among the Topics—Edison Medal Will Be Awarded

ONE of the best rounded programs ever presented at a meeting of the American Institute of Electrical Engineers is promised by the completed announcement of the winter convention, to be held in New York on Monday to Friday, January 28 to February 1 inclusive. The final program includes four selected papers in the field of dielectrics and electrophysics, five on cables, five on transmission and lightning, four on protective devices, four in the field of communication, five on induction motors, five on electrical machinery, five concerning electrical measurement of non-electrical quantities and allied topics, and five on instruments and measurements. These papers, 42 in all, are listed below.

On Wednesday evening the Edison medal will be presented to Frank B. Jewett, and H. E. Howe, editor *Industrial and Engineering Chemistry*, will lecture. Inspection trips, a smoker and a dinner-dance are other events.

Program of Winter Convention of the A.I.E.E.

NEW YORK, JANUARY 28 to FEBRUARY 1, INCLUSIVE

MONDAY, JANUARY 28

Morning.—Registration; committee meetings.

Afternoon.—Dielectrics and Electrophysics: "Anomalous Conduction as a Cause of Dielectric Absorption," J. B. Whitehead and R. H. Marvin, Johns Hopkins University; "Flux Linkages and Electromagnetic Induction," L. V. Bewley, General Electric Company; "Corona Ellipses," V. Karapetoff, Cornell University; "Power Factor and Dielectric Constant in Viscous Liquid Dielectrics," D. W. Kitchin, Simplex Wire & Cable Company.

TUESDAY, JANUARY 29

Morning. — Cables: "High-Tension Underground Cable Research and Development," G. B. Shanklin and G. M. McKay, General Electric Company; "Some Problems in High-Voltage Cable Development," E. W. Davis and W. N. Eddy, Simplex Wire & Cable Company; "Ionization Studies in Paper-Insulated Cables—II," C. L. Dawes, H. H. Reichard and P. H. Humphries, Harvard Engineering School; "Reduction of Sheath Losses in Single-Conductor Cables," Herman Halperin and K. W. Miller, Commonwealth Edison Company; "Losses in Armored Single-Conductor Lead-Covered Cable," O. R. Schurig, H. P. Kuehni and F. H. Buller, General Electric Company.

Afternoon.—Transmission and Lightning: "A Graphical Theory of Traveling Electric Waves Between Parallel Conductors," V. Karapetoff, Cornell University; "Progress in Lightning Research in the Field and the Laboratory," F. W. Peek, Jr., General Electric Company; "1927 Lightning Experience on 132-Kv. Transmission Lines," Philip Sporn, American Gas & Electric Company; "Theoretical and Field Investigations of Lightning," C. L. Fortescue and J. H. Cox, Westinghouse Electric & Manufacturing Company; "Protection of Transmission Lines from Interruption by Lightning," report by subcommittee of power transmission and distribution committee.

Evening. — Smoker and entertainment.

WEDNESDAY, JANUARY 30

Morning. — Protective Devices: "Theory of the Deion Circuit Breaker," Joseph Slepian, Westinghouse Electric & Manufacturing Company; "Structural Development of the Deion Circuit Breaker," C. R. Dickinson and B. P. Baker, Westinghouse Electric & Manufacturing Company; "Field Tests on the Deion Circuit Breaker," B. G. Jamieson, Commonwealth Edison Company; "Automatic Reclosing High-Speed Circuit-Breaker Feeder Equipment for Direct-Current Railway Service," A. E. Anderson, General Electric Company.

Afternoon.—Inspection trips.

Evening. — Medal presentation and lecture.

THURSDAY, JANUARY 31

Morning.—Communication: "Applications of Radio in Aviation," J. H. Dellinger, Bureau of Standards; "Influence of Moisture and Electrolytes Upon Textiles as Insulators," R. R. Williams and E. J. Murphy, Bell Telephone Laboratories; "Purified Textile Insulation for Telephone Central-Office Wiring," H. H. Glenn and E. B. Wood, Bell Telephone Laboratories; "Vector Representation of Wave Filters," R. F. Mallina and O. Knacknuss, Victor Talking Machine Company. Parallel session—Induction Motors: "The Condenser Motor," B. F. Bailey, University of Michigan; "The Fundamental Theory of the Capacitor Motor," H. C. Specht, Westinghouse Electric & Manufacturing Company; "The Revolving-Field Theory of the Capacitor Motor," W. J. Morrill, General Electric Company; "Line-Start Induction Motors," C. J. Koch, General Electric Company; "Calculating No-Load Core Losses in Induction Motors," Thomas Spooner, Westinghouse Electric & Manufacturing Company.

Afternoon. — Electrical Machinery: "Insulation Tests of Electrical Machinery Before and After Being Placed in Service," C. M. Gilt, Brooklyn Edison Company, and B. L. Barns, Canadian General Electric Company; "Influence of Temperature on Large Commutator Operation," F. T. Hague and G. W. Penney, Westinghouse Electric & Manufacturing Company; "Effect of Transient Voltages on Power-Transformer Design," K. K. Palueff, General Electric Company; "Transient Analysis of Alternating-Current Machines," Yu H. Ku, Massachusetts Institute of Technology; "Two-Reaction Theory of Synchronous Machines—I," R. H. Park, General Electric Company.

Evening.—Dinner-dance.

FRIDAY, FEBRUARY 1

Morning.—Electrical Measurement of Non-Electrical Quantities: "Magnetic Analysis of Materials," R. L. Sanford, United States Bureau of Standards; "Use of the Oscillograph for Measuring Non-Electrical Quantities," D. F. Miner and W. B. Batten, Westinghouse Electric & Manufacturing Company; "Study of Noises in Electrical Apparatus," Thomas Spooner and J. P. Foltz, Westinghouse Electric & Manufacturing Company; "Measurements of Flow by Use of Electrical Instruments," W. H. Pratt, General Electric Company; "Electrical Aids to Navigation," R. H. Marriott, consulting engineer.

Afternoon.—Instruments and Measurements: "Telemetering," C. H. Linder, H. B. Rex and C. E. Stewart, General Electric Company; "Totalizing of Electric System Loads," P. M. Lincoln, Cornell University; "A New High-Accuracy Current Transformer," M. S. Wilson, General Electric Company; "132-Kv. Shielded Potentiometer for Determining the Accuracy of Potential Transformers," C. T. Weller, General Electric Company; "A Precision Regulator for Alternating Voltage," H. M. Stoller and J. R. Power, Bell Telephone Laboratories.

Electrical Papers at Midwest Power Conference

Four of the technical sessions at the Midwest Power Conference in Chicago next month, of whose program a general outline has already been printed in the ELECTRICAL WORLD, have special interest for electrical engineers and power-station men. At these sessions the following papers will be given:

TUESDAY AFTERNOON, FEB. 12.

Power-Plant Substructure Problems: "Details of Design and Construction of the Stream-Flow Power Plants at Louisville," H. G. Roby, Byllesby Engineering & Management Corporation, Chicago; "Power-Plant Substructure Problems," J. C. Sanderson, Sargent & Lundy, Chicago; "Design and Construction of Substructure of Steam Power Stations in Various Localities in the United States," P. E. Stevens, Byllesby Engineering & Management Corporation, Chicago.

WEDNESDAY AFTERNOON, FEB. 13

Electrical Engineering Problems: "Synchronous Supervisory System and Telemetering," C. E. Stewart, General Electric Company; "Sightseeing Among the Atoms and Molecules," Prof. G. L. Clark, University of Illinois.

THURSDAY AFTERNOON, FEB. 14

Power-Plant Operation: "Centrifugal Pump Economics," Prof. A. F. Scherzer, University of Michigan; "Co-ordination of Industrial-Plant and Central-Station Power," P. J. Gaudy, Sessions Engineering Company, Chicago; "Welding in Power-Plant Construction and Maintenance," H. H. Moss, Linde Air Products Company, New York.

FRIDAY MORNING, FEB. 15

Power-Plant Economics: "Pressure at 1,200 Lb. as a Dollar Saver," Edwin Jowett, Kansas City Power & Light Company; "Plant Practice and Engineering Insurance," J. P. Morrison, Hartford Steam Boiler Inspection & Insurance Company, Chicago; "Modern Stoker Equipment," C. F. Hirshfeld, chief of research, Detroit Edison Company.

Other papers are on the utilization of power in chemical industries, by C. M. A. Stine of the Du Pont Company, on Wednesday morning, and on the steam turbine, by R. C. Allen of the Westinghouse Electric & Manufacturing Company, at the Thursday luncheon.

N.E.M.A. May Indorse Trade Practice Conferences

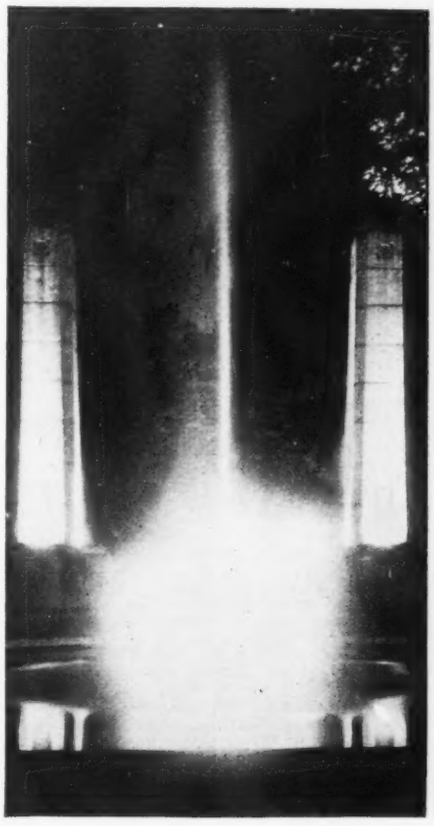
Industry trade practice conferences will be the chief topic for discussion at the midwinter meeting of the National Electrical Manufacturers' Association to be held the week of January 21 at the Hotel Commodore and N.E.M.A. headquarters in New York. It is expected that many of the sections will take action requesting the Federal Trade Commission to call such conferences.

At the general session on Wednesday afternoon the principal address will be that of Charles J. Graham, president of the Bolt, Nut and Rivet Manufacturers' Association, who will speak on "Problems of Distribution." It is also expected that the report of the J. Walter Thompson Company giving its analysis of the national electrical market in the home and its plan for market development under the Electrical Industry Sales Conference will be presented at that time.

Tariff revision, as it affects the electrical manufacturing industry, will be another association topic, and a brief report of what took place at the preliminary hearings in Washington before the ways and means committee of the House will be given by Thomas Allen, chairman of the N.E.M.A. tariff committee.

Briefer News

GRAND RAPIDS HAS PERMANENT ELECTRIC FOUNTAIN.—Much admiration has been elicited in Grand Rapids, Mich., by the installation at a park entrance of an electric fountain of General Electric "Novalux" type. In combination with the floodlighted entrance way it adds a spectacular feature to the city's appearance after sunset.



NEW MUNICIPAL PLANT READY.—The Hamilton (Ohio) new municipal electric light plant of Hamilton, Ohio, which has cost the city approximately $900,000, exclusive of real estate, is now ready for operation. Contemplated improvements will bring the cost to approximately $1,250,000, it is reported.

TRANSMISSION-LINE EXTENSION IN SOUTH DAKOTA.—Approximately $250,000 is being expended by the Central West Public Service Company of Omaha in extending a line from its central hydro-electric plant at White River, S. D., to Chamberlain, in the same state. It will connect with intermediate towns. Two steel towers are being built on either side of the Missouri River at Chamberlain to carry the heavy cables over a span of about 1,800 ft. of Missouri water and sand.

NEW OFFICE BUILDING FOR DURHAM, N. C.—A three-story office and merchandising building has recently been completed at Durham, N. C., for the Durham Public Service Company—a Henry L. Doherty organization. Executive and departmental offices fill the two upper floors, electrical appliance rooms the ground floor. The Christmas window display won a cup offered by the Durham Merchants' Association.

COLORADO MAY GET TWO NEW HYDRO-ELECTRIC PLANTS.—A bill which United States Senator Phipps is pushing and which is understood to have received the indorsement of the Secretary of the Interior will give Colorado two new hydro-electric power plants. One will be at Orchard Mesa and the other will form part of the Uncompahgre irrigation project at Montrose.

JUBILEE OF THE BBITISH CARBON-FILAMENT INCANDESCENT LAMP.—On December 20 the British Institution of Electrical Engineers commemorated in London the jubilee of the carbon-filament incandescent lamp which was shown in public for the first time by the late Sir Joseph Swan at Newcastle-on-Tyne on December 18, 1878. Samples of early lamps were on exhibition.

BROWN-BOVERI TURBINE AT HELL GATE STATION IN PRELIMINARY OPERATION.—The 160,000-kw. Brown-Boveri turbo-generator in the Hell Gate station of the United Electric Light & Power Company, New York, which was described in comparison with its Westinghouse neighbor in the ELECTRICAL WORLD for December 22 (page 1264), has been placed in preliminary operation.

FORD TO DOUBLE SIZE OF GENERATING PLANT ON RIVER ROUGE, DETROIT.—A two-mile water tunnel with a capacity of 1,000,000,000 gal. daily will be built by the Ford Motor Company for the purpose of enabling it to double the size of its electric power plant on the River Rouge, Detroit. Title to the structure, which will cost $2,500,000 to build, will rest in the city. The entire cost will be borne by the Ford Motor Company, which will have exclusive use of the tunnel.

EMPORIA'S MAYOR HAS RADICAL VIEWS ON THE KANSAS COMMISSION.—Mayor Oliver T. Anthony of Emporia, Kan., does not approve of the Kansas Public Service Commission, because it

"has come to feel that it is not a prosecuting body," but "rather a court of justice which sits enthroned upon a cloud of legal generalities and deigns to hear the grievances of the people." In making his views public the Mayor pleads for a "vigorous prosecuting body which shall employ experts for the defense of Kansas towns, which aggressively shall collect evidence in their behalf and consider the evidence, not with the lofty impartiality of a trial judge, but with the honest zeal of a prosecuting attorney."

NEW 42-MILE LINE IN NEW MEXICO.—An extension of the power transmission system of the Texas-Louisiana Power Company in New Mexico is under way. The new line, which runs from Silver City to Lordsburg, 42 miles, will be completed about the middle of January. The company will also erect an office building in Silver City.

NEW INTERSTATE LINE FROM TULSA, OKLA., TO FAYETTEVILLE, ARK.—Material is being assembled by the Public Service Company of Oklahoma for construction of a transmission line from Tulsa to Watts, Okla., connecting at the latter place with the electric transmission system of the Arkansas Gas & Electric Company. This will bring about interconnection between Tulsa and Fayetteville, Ark. The Public Service Company has recently completed a high line between Red Oak and Talihina, Okla. Another connection is soon to be built between Atoka and Antlers.

UNDERGROUND DISTRIBUTION PROPOSED FOR ORLANDO, FLA., TO SAFEGUARD SERVICE DURING STORMS.—Consideration is being given by the Orlando (Fla.) Utilities Commission, in control of the city plant, to the erection, as a preventive of damage to the electrical poles and wires during storms, of a downtown substation from which underground cables would run to business houses, factories and other establishments in the center of the city now served by the overhead transmission system.

ELECTRICAL GROWTH IN EASTERN TENNESSEE.—The Bristol Gas & Electric Company and the Watauga Power Company of Bristol, subsidiaries of the Cities Service Company, New York, have finished a 44,000-volt line from the hydro plant on the Watauga River to Butler, Tenn., and an 18-mile 11,000-volt line between Butler and Mountain City, Tenn. The projected 40,000-hp. hydro plant of the Tennessee Eastern Power Company on the Holston River, now in the preliminary stage only, will aid this eastern Tennessee section.

SUPERSESSION OF OREGON COMMISSION SOUGHT IN PORTLAND ELECTRIC POWER VALUATION.—Kenneth H. Harlan, a special engineer in the employ of the city of Portland, wants the municipal authorities to petition the Governor to appoint a new commission to evaluate for rate-making purposes the properties of the Portland Electric Power Company, a task on which the existing Public Service Commission is actively engaged. Mr. Harlan alleges that the present commission is biased and wants an entire change in its personnel before the city proceeds with the introduction of evidence. This unusual method of procedure is recommended because the commission declines to go back of the figures of a 1916 valuation of the same properties and bring the appraisal up to date. The commission holds that inasmuch as the 1916 valuation has not been questioned as to its accuracy for the past twelve years there is no reason why the old figures should not still apply.

NEW OFFICERS FOR NEW YORK ELECTRICAL CREDIT ASSOCIATION.—The New York Electrical Credit Association has just elected as president J. H. Lecour of the Mitchell-Rand Manufacturing Company, as vice-president E. R. Mellen of the Weston Electrical Instrument Corporation, and as secretary (re-elected) W. J. Kreger of New York City.

DUQUESNE LIGHT COMPANY TO SPEND $14,000,000 ON ELECTRICAL IMPROVEMENTS THIS YEAR.—Four million dollars is budgeted by the Duquesne Light Company of Pittsburgh for expenditure on its new James H. Reed power station at Brunot Island, Pittsburgh, in 1929 and $8,000,000 more for the improvement of distribution lines and other electrical expenditures.

NORTHWEST INSPECTORS AFFILIATE WITH INTERNATIONAL ASSOCIATION.—The executive committee of the Northwest Association of Electrical Inspectors has taken the necessary action to affiliate itself with the International Association of Electrical Inspectors as the Northwest Section. The third annual convention of the Northwest association since its formation three years ago will be held at Vancouver, B. C., on September 9-11.

OSWEGO RIVER (N. Y.) POWER RIGHTS SOLD.—The Syracuse Lighting Company is not interested in the sale to the Valley Improvement Association of power rights along the Oswego River owned by the Arrowhead Mills of Fulton, President James C. De Long of the Syracuse company has announced. These power rights, which amount to one-half of the power generated by the river at that point, are said to be worth in excess of $1,000,000. The Carlisle interests of Watertown and Oswego also deny being interested in them. Officials of the purchasing association would not discuss the transaction.

SEATTLE SELECTS SITE FOR ITS NEW SKAGIT POWER HOUSE.—Members of the Seattle City Council are in accord in the selection of a power-house site for the coming Diablo Dam. A location on the lower end of Reflector Bar, in the Skagit River, nearly half a mile from the dam, is favored. Definite plans for the tunnel await approval by consulting engineers. It is asserted that the city will have 8 ft. more head at the lower site. Estimates place the cost of constructing the tunnel and building and equipping the power house at $3,700,000. Another $3,000,000 must be spent on the dam.

MAYOR OF LITTLE ROCK, ARK., VETOES RATE ORDINANCE.—An ordinance authorizing the Arkansas Power & Light Company to revise its schedules for residential lighting, commercial lighting and small power users in Little Rock has been vetoed by the mayor of that city on the ground that he had been unable to obtain assurance from company officials that consumers of energy for commercial lighting and small power would be protected against an advance in cost. As a two-thirds majority of the alder-

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

Empire State Gas and Electric Association—Electric Section, United Engineering Societies Bldg., New York, Jan. 10 and 11. C. H. B. Chapin, Grand Central Terminal, New York.

American Engineering Council—Annual meeting, Washington, Jan. 14 and 15. L. W. Wallace, 26 Jackson Place, Washington.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Jan. 15 and 16. E. F. Kelley, Louisville Railway Co., Louisville.

North Central Electric Association — Engineering Section, Minneapolis, Jan. 21-22; Commercial Section, Minneapolis, Feb. 25 and 26. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 21-26. S. N. Clarkson, 420 Lexington Ave., New York.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 28-Feb. 1; regional meeting, Cincinnati, March 20-22. F. L. Hutchinson, 33 West 39th St., New York.

Artistic Lighting Equipment Association and Illuminating Glassware Guild—Cavalier Hotel, Virginia Beach, Norfolk, Va., Feb. 6-8. G. P. Rogers, 420 Lexington Ave., New York.

Midwest Power Conference — Chicago, Feb. 12-16. G. E. Pfisterer, 53 W. Jackson Blvd., Chicago.

New Mexico Utilities Association — Franciscan Hotel, Albuquerque, Feb. 18-20. Bernard L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

Iowa Section, N.E.L.A.—Operators' Section, Sioux City, Feb. 26-27. H. E. Weeks, Davenport, Iowa.

Oklahoma Utilities Association—Oklahoma City, March 12-14. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

Arizona Utilities Association—El Conquistador Hotel, Tucson, April 18-20. Lee C. McCullough, 134 South Central Ave., Phoenix.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs, Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

men would be necessary to repass the ordinance the Mayor's action will probably end for the present agitation that has existed for some time over rates, leaving the old ones in force. The ordinance may be submitted to popular vote.

ENLARGEMENT OF JORDAN RIVER HYDRO PLANT ON VANCOUVER ISLAND CONTEMPLATED.—Additional power requirements of Victoria, the capital of British Columbia, and the surrounding district on Vancouver Island are to be met by a program of development at the Jordan River hydro-electric undertaking. This will be spread over a term of years and represent an investment of about $1,800,000, it is announced by the British Columbia Electric Railway Company. A fourth unit, with a capacity of 15,000 hp., will be installed, bringing the rating of the Jordan River development up to 40,000 hp. This plant has one of the highest heads in Canada—1,145 ft.

HOLYOKE MUNICIPAL PLANT AGAINST UNIFORM UTILITY ACCOUNTING. — Manager John J. Kirkpatrick of the Holyoke (Mass.) Municipal Gas and Electric Department charges that the Holyoke Water Power Company is seeking to cripple its rival's business. Mr. Kirkpatrick appeared before the Department of Public Utilities recently and declared that that body should make a thorough study before attempting to establish production costs of municipal plants as directed by the General Court. Recognizing interest and depreciation in municipal-plant accounting would call for a radical change in the present system, Mr. Kirkpatrick declares. Business would go to private companies, and Holyoke's investment in its municipal plant might become a total loss.

FURTHER DEVELOPMENT ON PECOS RIVER IN TEXAS PLANNED.—Surveys are being made by the Central Power & Light Company for a dam across the Pecos River about 8 miles from the point where it empties into the Rio Grande. The company is understood to plan a large hydro-electric plant. At the site of the proposed dam the bed of the Pecos River is 100 ft. higher than that of the Rio Grande, and by constructing a 100-ft. dam a head of 200 ft. could be obtained by diverting the water into the Rio Grande through a 2,600-ft. tunnel. The Central Power & Light Company has obtained permits from the State Board of Water Engineers to construct five power dams on the Devil's River. It has completed one of these projects and is at work on the second one.

LOWER RATES FOR COLUMBUS, OHIO. —Large consumers of electric power and persons utilizing modern household electrical appliances will be the principal beneficiaries from the 1929 schedule of rates just announced by C. C. Slater, president and general manager of the Columbus (Ohio) Railway, Power & Light Company. The new schedule, which is to be effective on and after February 1, calls for a rate of 8 cents per kilowatt-hour per month for the first 50 kw.-hr., with 1 cent reduction on bills paid on or before the last specified date; 6 cents for the next 75 kw.-hr. and 5 cents for the next 100 kw.-hr., with the same reduction. The minimum monthly service charge has been raised from 50 cents to 75 cents. For underground direct-current service within the district served from direct-current mains, the rates range from 8 cents per kilowatt-hour for the first 75 kw.-hr. down to 2 cents where the consumption is more than 100,000 kw.-hr. All of the readings will be on the same meter.

Recent Court Decisions

SUPREME COURT REFUSES HEARINGS IN TWO NOTED CASES. — Reviews have just been denied by the United States Supreme Court in two cases of interest to the electrical industry. One was in the case decided against the General Electric Company and in favor of the De Forest Radio Company and the Robelen Piano Company concerning the patentability of ductile-tungsten processes (ELECTRICAL WORLD, January 29, 1927, page 272). The other was in Horton vs. Public Service Commission and Niagara, Lockport & Ontario Power Company, in which the New York Court of Appeals upheld the state water-power law in its eminent-domain provisions (ELECTRICAL WORLD, June 2, 1928, page 1159).

DISCOVERY OF TAMPERING DOES NOT JUSTIFY IMMEDIATE REMOVAL OF METER WITHOUT REPLACEMENT WHEN NO CHARGE AGAINST USER IS MADE.—The Supreme Court of Louisiana awarded $500 damages to the plaintiff in Finnin vs. New Orleans Public Service, Inc., because an employee of that company who had, at plaintiff's request, been sent to replace a blown fuse discovered that the meter had been tampered with and at once removed it, leaving the family without light. Finnin had occupied the premises only two months and professed ignorance of the meter tampering. The court said: "Obviously, if the meter was removed because it was a fire hazard, it was the duty of the defendant immediately to replace it with another meter, so that plaintiff and his family would not be deprived of all electric service. Obviously, again, if the meter was removed solely because it had been tampered with, but without any charge that plaintiff was guilty of the act, the obligation rested upon defendant to proceed in the same way."

NEBRASKA SUPREME COURT ORDERS REARGUMENT IN HARTINGTON CASE. — The Nebraska Supreme Court has ordered a reargument at its February 4 session of the Interstate Power Company case, already reported in these columns as involving questions of unusual importance to the power industry. The original action pivoted upon the question of whether electrical energy is a commodity or a service and whether the courts have the power to fix minimum rates that companies may make in competition. If it is held to be a commodity, the state law would apply that compels the same charges in all towns similarly situated. To these questions, however, the Supreme Court, in its order for a rehearing, adds one still more important. The state constitution adopted in 1920 reserves to the people of the state the beneficial use of all streams for power purposes. The court says that the evidence shows that the Interstate company has contracted to obtain from a power development on the Niobrara, authorized by the state, all of the energy used in the forty-odd towns in northeastern Nebraska that it serves, and also that the rates charged in Hartington, the one plant involved in the original case, are less than half those charged in the other towns similarly situated. The court, therefore, asks for argument on the question whether the constitutional provision impresses the distinctive and distinguishing qualities of a public charity upon electrical energy generated by the use of streams of the state and vests in the people the exclusive and inalienable right to enjoy the use of these on the basis of substantial equality. It also wants argument on the question of whether the 6-cent rate made by the Hartington plant is lower than reasonably necessary and whether the court should wait until experience determines this. The case was begun by the state's Attorney General to prevent the Hartington plant of the company from crushing the competition of the new city plant by making a rate 3 cents below its schedule. He wanted, but was denied, an order that it charge the same rate in towns similarly situated as fixed at Hartington, or *vice versa*. The trial court held electrical energy to be a commodity and said the company would not be allowed to cut rates more than a cent below those of the city. (ELECTRICAL WORLD, October 6, 1928, page 704.)

Commission Rulings

NASHVILLE COMPANY ORDERED TO OPERATE RAILWAY AND ELECTRIC DIVISIONS JOINTLY.—Fixing the valuation of the property of the Nashville Railway & Light Company at $17,500,000 with a total valuation of depreciable property of $13,950,000 as of June, 1926, as a basis for computing the rate of return, the Tennessee State Railroad and Public Utilities Commission has ordered the company to operate the railway and electric divisions as joint property and compute the rates from the net results of this joint operation.

TERRITORY SOUGHT BY TWO COMPANIES GRANTED TO THE ONE WHOSE EXISTING SYSTEM IS THE NEARER.—The application of the St. Lawrence County Utilities for approval of the construction of an electrical distribution system in Macomb, N. Y., was granted by the Public Service Commission of that state and a like application by the Oswegatchie Power & Light Company was denied. Both companies had obtained franchises from the town board. It was shown that the St. Lawrence company's distributing system now runs to Edwardsville, near Macomb, and that lines could also be run to Macomb from nearby company territory at another point. The Oswegatchie company has a distribution line in Gouverneur, from which about 15 miles of construction would be required. The population of Macomb is not sufficient to justify construction by the two companies, the commission held, and its authority was granted to the nearer one.

News About Men of the Industry

Millikan Heads Association for Advancement of Science

Dr. Robert A. Millikan, who was elected president of the American Association for the Advancement of Science, as announced in the Jan. 5 issue of the ELECTRICAL WORLD, has been an outstanding figure in scientific and engineering circles for a number of years. As executive head of the California

R. A. Millikan

Institute of Technology and director of the Norman Bridge Laboratory of Physics at that institution since 1921, he has devoted himself to experimental researches, the results of which have been his chief claim to recognition. Perhaps the most noteworthy of his works are his "oil-drop" experiments, undertaken for the purpose of making precise measurements of the fundamental electrical quantity, and his work on photo-electric effect and his measurement of the H constant, which concerns the growth and decay of photo-electric phenomena.

Dr. Millikan's achievements have won frequent recognition in the past, so that this recent election to the presidency of the American Association for the Advancement of Science adds just another link to a chain of honors. He has been the recipient of the Edison medal of the American Institute of Electrical Engineers, the medal of the American Society of Mechanical Engineers, the Hughes medal of the Royal Society of Great Britain, the Nobel prize of the Swedish Academy and the Faraday medal of the London Chemical Society. He was affiliated with the teaching staff of Oberlin College and the University of Chicago before taking up his scientific work at the California Institute of Technology.

W. D. COLLINS, who has been acting chief engineer for Servel, Inc., has been appointed chief engineer with complete charge of all engineering. Mr. Collins has been with the Servel organization since January, 1926, entering its employ as assistant engineer on refrigeration, automobile bodies and gas engine production. He was formerly associated with the Premier Motors, Stutz, Gardner Motor and H. C. S. Motor Car Company as assistant chief engineer, being direct assistant to H. C. Stutz, having charge of engineering and design and in charge of production.

JOHN E. ZIMMERMANN has been elected a director of the Philadelphia Electric Company to fill the vacancy caused by the death of Jeremiah J. Sullivan.

J. EVERETTE BROWN has been appointed supervisor of merchandise sales for the Philadelphia Suburban-Counties Gas & Electric Company with headquarters in Philadelphia.

COL. ANTHONY R. KUSER, a director of the Public Service Corporation of New Jersey since its formation in 1903, has resigned as director of the corporation and subsidiary companies because of ill health. He was also a member of the executive committee. Colonel Kuser was one of the original 24 directors of the corporation on its organization in June, 1903. He was also at that time made second vice-president, and continued as a vice-president until 1923, when he resigned, retaining his position, however, on the directorate.

HARRY C. HYATT, formerly connected with the Ohio Bell Telephone Company, has been appointed to the staff of the Davey Tree Expert Company. A graduate of a forest school, Mr. Hyatt spent five years as city forester of Cleveland before affiliating himself with the Ohio Bell system three years ago to carry out the program dealing with its interfering tree problem. His extensive experience and the exhaustive study he has given to this special phase of engineering, involving, as it does, the public relations problem, eminently qualify him for his new position. Mr. Hyatt is the author of the handbook entitled "Standard Tree Methods."

EDWARD G. LEE, formerly engineer in the hydro division of Stone & Webster, Inc., of Boston, is now head of the estimating department of the New England Power Association, Boston, Mass. After a few years of sales experience, Mr. Lee became an engineering assistant in the offices of Sawyer & Moulton, Portland, Me., and from this position he was transferred to Lewiston, Me., where he was in charge of the engineering office of W. H. Sawyer, senior partner of Sawyer & Moulton. Later he joined the Southern Power Company, Charlotte, N. C., but after two years he returned to Lewiston as engineer for Sawyer & Bean. For several years he was chief designing engineer in the Central Maine Power Company before he entered the employ of Stone & Webster.

H. A. Barre Chief Engineer of California Edison Company

H. A. Barre, executive engineer for the Southern California Edison Company, has been appointed chief engineer in charge of all engineering for the company, effective Jan. 29. He will report to George C. Ward, executive vice-president. Mr. Barre first entered the electrical industry in 1897 when he entered the employ of the Redland Electric Light & Power Company as an operator in its Mill Creek plant. In 1899 he went into the San Joaquin Valley to help start the Mount Whitney Power Company. He opened up what is now Kaweah No. 1 plant of the Southern California Edison Company. At that time Emory Wishon was a helper for Mr. Barre in the operation of that small hydro plant. Later Mr. Barre worked with a firm of consulting engineers handling Huntington properties.

In 1911 he joined the Pacific Light & Power Corporation, which at that time

H. A. Barre

was beginning operation in the development of the Big Creek-San Joaquin hydro-electric system. Mr. Barre joined them for the purpose of aiding them in that work in the capacity of electrical-mechanical engineer. When the Pacific Light & Power Corporation joined the Southern California Edison Company in 1917 Mr. Barre was made executive engineer for the Edison company, which position he has held to this date. He has been prominent in the development of new fields of thought in electrical generation and transmission. The development of the 220,000-volt long-distance line by the Edison company was very largely under his direct supervision. Mr. Barre takes an active part in the affairs of the American Institute of Electrical Engineers and the National Electric Light Association.

BLACKWELL NEWHALL, who has been connected with the United Gas Improvement Company for the past two

years, has been elected assistant secretary of the company. Mr. Newhall was formerly special assistant to the vice-president in charge of finance. Earlier in his career he had been assistant power engineer of the Philadelphia Electric Company.

B. S. Robinson Joins Staff of "Electrical World"

B. S. Robinson has been appointed assistant editor of the ELECTRICAL WORLD. Mr. Robinson comes to the editorial staff with a varied experience. For the past three years he was engineer for R. W. Cramer & Company of New York, where he was engaged in sales engineering and for whom he did a large amount of research work. Prior to that he was in the special engineering section of the Philadelphia Electric Company, serving there for two years. As assistant supervisor of telegraph and signals, Pennsylvania Railroad, which position he held from date of discharge from the army, he had supervision of design, installation and maintenance of signal and interlockers and telephone work. He saw more than two years active service in the 81st Division, U. S. Army, being in France almost a year. Prior to the war he was

B. S. Robinson

engaged in installation and inspection of interlockers on the Pennsylvania Railroad. Mr. Robinson was graduated from the University of Pennsylvania in 1914 as B.S. in electrical engineering and was awarded the graduate degree of E.E. in June, 1928. He is a member of the A.I.E.E.

THOMAS C. MCBRIDE, engineer of the Worthington Pump & Machinery Corporation, Philadelphia, was awarded the John Scott medal by the Franklin Institute for his invention of the locomotive feed-water heater. In addition to the medal a certificate and a premium of $1,000 were presented to him.

JOHN F. MURRAY has been appointed a member of the New York-New Jersey Port Authority by Governor Roosevelt to succeed the late Herbert K. Twitchell of Brooklyn. Mr. Murray was born in Albany, N. Y., and was educated at the Stevens Institute of Technology, Hoboken, N. J. For many years he was vice-president and general manager of the Metropolitan Service Corporation, Brooklyn, and in 1923 he became executive vice-president of Thomas E. Murray, Inc., New York City, consulting engineers, the position he now holds, together with vice-presidencies in the Metropolitan Engineering Company of Brooklyn, the Murray Radiator Company and the Murray Conduit Systems.

J. H. HUBBARD of New York has been elected president of the Lake Ontario Power Corporation, recently purchased by the Rochester Central Power Corporation. Herman Russell, vice-president of the Rochester Gas & Electric Corporation, has been named vice-president of the Lake Ontario utility. C. A. Tucker was elected treasurer and J. C. Collins secretary.

L. R. KING, appraisal engineer for the United Light & Power Company, has been made assistant general manager of that company and of the United Light & Power Engineering & Construction Company. Mr. King's early experience in the public utility field was in the railroad branch of the industry. Because of his understanding and appreciation of the relation between the general public and utilities and his ability to present financial and operating situations clearly and accurately before city officials, public service commissions and similar bodies his services came into demand by all properties owned by the United Light organization. In the course of time he built up an important department serving United Light subsidiaries in appraisal matters, rates, insurance and taxation. In 1923 he received the title of rate and appraisal engineer. In addition to his new duties Mr. King will continue his work in the appraisal department.

H. B. Utter Receives Promotion in Chicago

Henry B. Utter, who has been connected with the statistical department of the Commonwealth Edison Company, Chicago, for the past five years, has been elected to the position of assistant auditor by the company's board of directors. In the course of his affiliation with the Commonwealth organization Mr. Utter has established an enviable reputation as a capable and enterprising worker, and his promotion to a position of broader responsibilities naturally followed. His experience with fixed

H. B. Utter

capital and property records in the Commonwealth organization and, previous to that, in the Detroit Edison Company makes him well fitted for his new work.

William L. Parsley will take over Mr. Utter's former duties in the statistical department.

Obituary

HERR OTTO BONDY, one of the pioneers of electric cable manufacture in Austria and Hungary, died recently in Vienna at the age of 83.

HENRY CAHN, president of the Cahn-Foster Electric Company, Denver, Colo., died December 29, following an attack of influenza.

BENJAMIN N. DUKE, who at one time was deeply interested in water-power development in the South, died January 8 at his home in New York in his seventy-fourth year. He had been in ill health for several years and had been confined to his home for months. In addition to his tobacco interests, the foundation on which was built the family's fortune, Mr. Duke was connected financially with the cotton industry, real estate, railroads and banking, but at the time of his death he had withdrawn from most of his active business pursuits. The only offices he held were those of director of the Duke Power Company and vice-president of the Durham Realty Corporation, which owns the Hotel St. Regis in New York and various apartment houses in New York and New Jersey. It was his brother, the late James B. Duke, who built up the Southern Power Company from its early beginnings.

JOSEPH W. LEGG, one of the leading engineers in the study of oscillography, died Jan. 2 at Wilkinsburg, Pa., as a result of pneumonia. As a member of the meter engineering staff of the Westinghouse Electric & Manufacturing Company, Mr. Legg was responsible for the development of many electrical devices. His greatest fame resulted from his invention of the "Osiso" a small portable oscillograph, for which many uses have been found. Mr. Legg was born 41 years ago in Worcester, Mass., and received his technical education at the Worcester Polytechnic Institute. He was the author of many technical articles and held membership in the A.I.E.E. and other professional associations.

Financial and Statistical News

Markets Await Action on Money Rate Policy

Large Investors Still Accumulating Utility Common Stocks—Many Issues Selling at Twenty Times Earnings

THE dominant market feature of the first ten days of the new year has been continued optimism tempered by uncertainty concerning the probable policy of the Federal Reserve banks with regard to money rates. Professionals and the public alike are awaiting their cue and price levels have not changed so much as day-to-day reports might indicate. The widening gap between the trend and volume of business on the one hand and the securities markets on the other leaves traders without an indicator on which they so often depended in the past. The upward trend of the markets has been so rapid in relation to the trend of business that correlation is no longer easy to trace.

Common stocks of the power and light companies are now selling somewhere between fifteen and twenty-five times earnings, on the average, in comparison with ten to twelve times annual earnings five years ago. While regarded by some as a danger signal, this fact is interpreted by others as merely expressing a changed viewpoint with regard to the real value of these issues. In any event, the large investors, who are usually the most critical investors, are accumulating utility stocks at these levels, presumably for appreciation.

During the first week of January utility stocks were somewhat irregular, a mixture of gains and losses being recorded. On the big board American & Foreign Power receded seven points, Electric Power & Light five points and National Power & Light three points, but each later advanced several points. Slight advances were made by Pacific Gas & Electric and Engineers Public Service.

On the Curb several of the leading utility issues lost ground, including American Gas & Electric, Buffalo, Niagara & Eastern Power and Northeastern Power. Mohawk Hudson Power gained several points on merger rumors.

Utility Security Issues Decrease in California

Figures just released by the California Railroad Commission indicate that the security issues authorized by the commission for gas and electric utilities decreased from $183,877,100 in 1927 to $92,162,750 in 1928. This was largely due to the fact that some of the major hydro-electric projects started since the war have been completed and a temporary lull in development has been reached, and also to the fact that the process of retiring high interest bearing issues with those at lower interest rates, which began several years ago, has largely been completed. Most of the new money required by gas and electric properties during 1928 was used to finance additions to distribution facilities to care for the demands of new customers, which was about normal during the year.

Consolidations and reorganizations during 1928 occupied a part of the time of the commission, although there were no consolidations of a major character. Financing begun during 1927 by the Pacific Gas & Electric Company for the acquisition of the Western States Gas & Electric Company, Sierra & San Francisco Power Company and Coast Counties Gas & Electric Company were completed through the issue of $20,000,000 of bonds. Aside from this, purchases and mergers were confined to small gas, electric, water and telephone properties.

Electric Storage Battery Shows Profit of $4,741,985

The report of the Electric Storage Battery Company, including the Willard Storage Battery Company, to the New York Stock Exchange for nine months ended September 30, 1928, shows profit of $4,741,985 after expenses and charges, but before federal taxes. Deducting estimated federal taxes of $569,000, net profit is equal to $5.15 a share earned on 810,387 shares of combined common and preferred stocks. Consolidated income account for nine months ended September 30, 1928, shows gross sales amounting to $33,714,579; costs, expenses, etc., $29,447,511; profit from sales, $4,267,068; other income, $474,917; profit before federal taxes, $4,741,986; estimated federal taxes, $569,000; net profit, $4,172,985; dividends, $3,084,487; surplus, $1,088,498.

A Million Hydro-Electric Horsepower in Canadian Pulp and Paper

ACCORDING to a report compiled and just issued by the Water Power Branch of the Canadian government, the waterpower installation of pulp and paper mills in Canada now aggregates 565,362 hp., of which 283,009 hp. is directly connected to pulp and paper machines and 282,243 hp. to electric generators. In addition there is a large turbine installation in central-station plants producing the power sold to pulp and paper mills. Analysis of the figures for this power, sold both on the horsepower-year and the kilowatt-hour basis, indicates that the turbine installation must be virtually equal to the aggregate installation of the motors which utilize this power, namely, 789,530 hp. The turbine installation supplying power to pulp and paper mills in Canada therefore aggregates, in round figures, 1,355,000 hp., of which 1,071,873 hp. is hydro-electric and the remainder direct hydro drive.

The total hydraulic installation utilized in the pulp and paper industry is over 28 per cent of the total installation for the whole Dominion and the power purchased in 1927 amounted to almost one-third of all the power produced for sale by central electric stations and earned for them about $11,500,000.

The use of steam as a source of power for this industry in Canada is very limited, the total installation amounting to only 120,352 hp., or 8.2 per cent of the total power installation and being usually prompted by special conditions, such as operation in close connection with the manufacture of lumber when refuse from the latter can be used as fuel under the boilers. There is also some slight use of internal combustion engines, engines rated at 763 hp. being installed.

Commenting on the relationship which water power bears to the pulp and paper industry in Canada, the report says: "The advantages of the conversion of hydraulic power to electrical energy appear both in the quality of the product, which is improved by the uniform speed obtained, and in the fact that under modern methods of transmission it is possible to develop power at sites more or less remote from centers of labor and transportation and to transmit it to points where these facilities are available for mill operation."

North Boston Lighting Stock Issue Announced

To shareholders of record March 8, the trustees of the North Boston Lighting Properties will offer the right to subscribe to one share of common stock at par, $50, for each ten shares of either preferred or common then held. The rights will expire March 29. Full payment may be made April 17 or by quarterly installments terminating January 17, 1930. The effect of this financing will be to establish a share capitalization of 228,078 shares of 6 per cent preferred and 433,352 shares of common. Last week the dividend rate on the latter was increased from $2.25 annually to $3. Recent quotations range from $60 to $64 for the preferred and from $87 to $90 for the common. The proceeds of

the issue will be utilized in financing improvements in the subsidiaries in the Malden, Gloucester, Haverhill and Eastern Massachusetts Electric Company territory. The North Boston properties are controlled by Charles H. Tenney & Company, Boston.

Larger Customer-Ownership Sales in October

Sales of electric light and power company stock to customers, employees and other local parties in October consisted of 28,300 transactions, involving 204,100 shares, valued at $15,332,000, according to reports received by the ELECTRICAL WORLD from the companies concerned. This is a decided increase over September and several preceding months, each characterized by sales of less than $10,000,000, though still short of the 1927 monthly average, which exceeded $20,000,000.

Several campaigns resulting in important investments by the public are indicated in the returns. Two of them accounted for more than $3,000,000 each; three others ran above $1,000,000. Half a dozen showed receipts ranging between $300,000 and $600,000. As usual, the majority of the reports indicated no sales during the month. Customer-ownership campaigns depend on local conditions; only a very few companies carry on sales continuously; the totals fluctuate between wide limits as more or fewer sales drives happen to be active in a given month.

Columbia Gas & Electric to Split Stock

Directors of the Columbia Gas & Electric Corporation at a meeting held January 4 recommended that the stockholders on April 4 ratify proposals to increase the common stock from 3,372,695 to 8,431,738 shares and to distribute the additional stock to shareholders on the basis of 2½ shares for each present share. Such action would give the stock a wider distribution by placing the market value of the shares within reach of the small investor. At the same meeting the number of directors was increased from fifteen to nineteen. The newly elected members of the board included Harry J. Crawford, Emlenton, Pa.; Charles A. Munroe, Chicago; Thomas W. Phillips, Jr., Butler, Pa., and William C. Potter, New York. The board also declared the regular quarterly dividends of $1.50 on the preferred and $1.25 on the common stocks, both payable February 15 to stock of record January 19.

INSULL UTILITY INVESTMENT BOARD.—In addition to the officers announced in the January 5 issue of the ELECTRICAL WORLD, the board of directors of the Insull Utility Investments, Inc., consists of the following members: Walter S. Brewster of Russell Brewster & Company; Britton I. Budd, president Public Service Company of Northern Illinois; Edward J. Doyle, vice-president Commonwealth Edison Company; Louis A. Ferguson, vice-president Commonwealth Edison Company; John F. Gilchrist, vice-president Commonwealth Edison Company; John H. Gulick, vice-president Commonwealth Edison Company; George F. Mitchell, vice-president Peoples Gas Light & Coke Company; Stuyvesant Peabody, president Peabody Coal Company; Marshall E. Sampsell, president Central Illinois Public Service Company; H. L. Stuart of Halsey, Stuart & Company, Inc., and Waldo F. Tobey of Isham, Lincoln & Beale.

ENGINEERS PUBLIC SERVICE PREFERRED HOLDERS CHANGE SHARES FOR COMMON.—Charles W. Kellogg, president of the Engineers Public Service Company, has announced that over 80,000 shares of the company's $5 dividend preferred have now been converted into common. The basis of conversion therefore changes automatically from nineteen shares of common for each ten preferred to seventeen common for each ten preferred until an additional 40,000 shares have been converted at the new rate.

Schwab's Ten Rules to Keep Prosperity

"Pay labor the highest possible wages. Prosperity is intimately related to a liberal wage scale.

"Treat labor as a business partner. Successful industry depends more on human relations than upon the organization of money and machines.

"Conduct business in the full light of day. Public confidence and public suspicion may be separated only by a door.

"Remember that the law of supply and demand is inexorable. It would also be well to remember that there is no necessity for producing an excess.

"Live and help live. Even prosperous industries cannot afford to have the backward industries too far behind the procession—prosperity to be permanent must be equably distributed.

"Welcome new ideas. To establish permanent institutions we must always be prepared for change.

"Never be satisfied that what has been achieved is sufficient. Smugness and complacency do not promote progress.

"Operate business on the most economical basis. Price-cutting, over-expansion, uneconomical methods of distribution are just as harmful to business and to the public as price-fixing, monopolies and rebates.

"Look ahead and think ahead. It is easier to avoid depressions than it is to cure them.

"Smile, be cheerful, and work upon the basis that the fundamental purpose of business is to promote the happiness of human beings."

Timken Assets Up 16 per Cent

The statement of the Timken Roller Bearing Company and subsidiaries, not including British Timken, Ltd., as of June 30, 1928, shows total assets of $41,163,885 compared with $35,523,694 on December 31, 1927, and earned surplus $29,077,842 against $25,679,340. Current assets totaled $27,982,547 and current liabilities $3,104,368 as compared with $24,246,428 and $1, 405,637, respectively, on December 31, 1927.

Assets:	June 30, 1928	Dec. 31, 1927
*Property, plant and equipment	$11,064,303	$9,502,523
Cash	2,878,663	583,529
Accounts and notes received	3,020,560	1,878,351
Inventories	5,301,823	4,970,082
Government securities and accrued interest	16,781,502	16,814,466
Deferred charges	409,592	133,397
Other assets	1,707,442	1,641,346
Total	$41,163,885	$35,523,694
Liabilities:		
†Capital stock	$6,000,000	$6,000,000
Accounts payable	2,211,837	1,194,070
Accrued taxes, etc	245,099	211,568
Federal tax 1927 unpaid installment	647,432	
Federal tax reserve	965,132	1,300,000
Contingent reserve	1,500,000	1,100,000
Other reserve	516,543	38,716
Earned surplus	29,077,842	25,679,340
Total	$41,163,885	$35,523,694

* After depreciation, amortization, etc. † Represented by 1,200,882 no-par shares.

The Consolidated balance sheet of the Timken Roller Bearing Company, not including British Timken, Ltd., as of June 30, 1928, compares as shown in the accompanying table:

GERMAN ELECTRIC COMPANIES ANNOUNCE PROFITS.—The board of directors of Siemens & Halske have announced that net profits for the year were 18,450,000 marks (about $4,600,000) and declared a dividend of 14 per cent, as against 10 per cent last year. The board of Siemens-Schuckert announced profits of 16,560,000 marks (about $4,135,000) and declared a dividend of 8 per cent as compared with 9 per cent in 1927.

SOUTHERN CANADA POWER REPORTS INCREASED EARNINGS.—For the fiscal year ended Sept. 30, the Southern Canada Power Company reports net profit of $674,074, after all charges, equal after preferred dividends to $3.77 a share on 100,000 common shares outstanding, compared with net of $474,742, equal to $2.50 a share on outstanding 72,000 shares in the preceding year. Gross revenues totaled $1,809,566, against $1,534,280. The number of customers increased from 21,662 at the end of the previous year to 23,552 at the end of this year. In presenting the report to shareholders J. B. Woodyatt, president, said in part: "The outlook for

industrial growth in the company's territory was never as good as it is today and it is expected that a continually accelerating movement by new industries intending to establish plants in Canada will be noticeable in the near future. Comparative statistics show that the kilowatt-hour output for the year was the largest in the history of the company, reaching 138,160,340 kw.-hr., as compared with 125,452,960 during the preceding year."

CROCKER-WHEELER PAYS ACCUMULATION DIVIDEND.—The Crocker-Wheeler Electric Manufacturing Company declared a dividend of 2 per cent on preferred stock on account of accumulations, which after this payment will amount to 12 per cent, and the regular quarterly dividend of 1¾ per cent, both payable January 15 to stock of record January 5.

HARTFORD ELECTRIC COMPANY INCREASES DIVIDEND RATE.—The Hartford Electric Light Company, Hartford, Conn., at a meeting of its directors voted to increase the dividend rate from $2.50 a share annually to $2.75 a share. On a quarterly basis the increase is from 62½ cents to 68¾ cents. The change will go into effect with the dividend payment as of Feb. 1, 1929.

ITALIAN SUPERPOWER ADDS TO DIRECTORATE.—Count Giuseppe Volpi di Misurata, formerly Finance Minister of Italy, has been elected to the directorate of the Italian Superpower Corporation. Angelo Forti, chairman of the General Electric Company of Sicily, Floyd B. Odlum, vice-prersident of the Electric Bond & Share Company, and S. A. Mitchell, vice-president of Bonbright & Company, Inc., were also elected directors.

Recent Listings

The New York Stock Exchange has authorized the listing of 5,393 additional shares of common stock, class A, without par value, of the General Gas & Electric Corporation, and 12,970 additional shares of common stock, class B, without par value, on official notice of issuance and payment in full, making the total amount applied for 366,866 shares of common stock, class A and 229,280 shares of common stock, class B. The New York Stock Exchange has also authorized the listing of 125,002 additional shares of common stock without par value, of the North American Company on official notice of issuance as a stock dividend of 2½ per cent payable Jan. 2, 1929, with authority to add to the list 11,150 shares, on official notice of issuance in exchange for 8,920 shares of common stock of Western Power Corporation, making the total number of shares applied for to date 5,148,112 shares. Foreign securities have also been authorized for listing, guaranteed secured mortgage sinking fund gold bonds of the Tyrol Hydro-Electric Power Company to the amount of $3,000,000 having been added. Among the manufacturing securities listed were 275,000 shares of common stock of Cutler-Hammer, Inc., without par value, on official notice of issuance share for share for outstanding common stock of Cutler-Hammer Manufacturing Company (the old company). There were also authorized for listing 81,038 additional shares of common stock of the Electric Storage Battery Company without par value, on official notice of issuance as a 10 per cent stock dividend.

LEHIGH POWER SECURITIES DECLARES INITIAL DIVIDEND.—An initial dividend of 25 cents per share was recently declared on the common stock, no par value, payable December 31 to holders of record December 20. The company has outstanding 3,104,450 common shares, of which the National Power & Light Company owns approximately 98 per cent.

AMERICAN EUROPEAN SECURITIES COMPANY ISSUES SHARES.—Cumulative preferred stock of the American European Securities Company, numbering 20,000 shares has just been offered to the investing public at $99 per share and accrued dividend from November 1, 1928, to yield over 6 per cent. This company was organized in 1925 to take over the assets of the Investment Company for Electrical Enterprises in the United States, a Swiss corporation.

INTERNATIONAL PAPER COMPANY MAKES OFFERING OF STOCK TO EMPLOYEES. International Paper Company is making an offering of International Paper & Power Company 7 per cent preferred stock to its employees. This is the fourth stock offering of the company. In the first offering—made in 1925—2,002 employees subscribed to a total of 7,189 shares; 2,677 employees subscribed to a total of 8,488 shares under the 1926 offering of preferred stock, and under last year's offering 3,310 employees subscribed to a total of 11,247 shares. The plan is designed to make it possible for all employees to become stockholders. Employees may pay for their stock in full or by installments as they prefer. In addition to the dividends on the stock the company pays a bonus each year if the subscriber is still in the employ of the company and still holds his stock. A bonus of $1 a share will be paid on Jan. 1, 1930, and increasing at the rate of $1 a share a year until a last fixed bonus of $5 a share is paid on Jan. 1, 1934.

Current Earnings Reports of Electric Light and Power Companies

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
American Power & Light & Subs. (Year ended Sept. 30)					
Gross earnings	$73,012,941	$62,429,718	16.9	52	55
Net earnings	35,056,551	28,262,286	24.1	..	..
Associated Gas & Electric (Year ended Nov. 30)					
Gross earnings	42,000,909	34,440,164	22.0	55	52
Net earnings	18,943,912	16,363,299	16.0	..	..
Blackstone Valley Gas & Electric & Subs. (Year ended Nov. 30)					
Gross earnings	6,053,017	5,907,202	2.5	61	64
Net earnings	2,334,395	2,121,803	10.0	..	..
Cities Service (Year ended Nov. 30)					
Gross earnings	34,272,956	32,925,032	4.1	..	..
Net earnings	33,115,373	31,821,368	4.1	..	..
Commonwealth Power (Year ended Nov. 30)					
Gross earnings	58,066,062	52,837,950	9.9	52	53
Net earnings	28,157,772	24,561,903	14.6	..	..
Consumers Power (Year ended Nov. 30)					
Gross earnings	30,123,849	26,418,745	14.0	50	52
Net earnings	15,143,693	12,805,826	18.3	..	..
Electric Power & Light & Subs. (Year ended Sept. 30)					
Gross earnings	54,079,591	52,110,492	3.7	54	55
Net earnings	24,788,721	23,260,398	6.5	..	..
Engineers Public Service & Subs. (Year ended Nov. 30)					
Gross earnings	31,303,850	29,354,615	6.6	58	61
Net earnings	12,998,349	11,333,732	14.7	..	..
Galveston-Houston Electric & Subs. (Year ended Nov. 30)					
Gross earnings	5,237,880	5,038,616	3.9	67	69
Net earnings	1,705,433	1,550,736	9.9	..	..

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
General Gas & Electric & Subs. (Year ended Oct. 31)					
Gross earnings	$23,089,363	$25,092,901	—8.0	42	45
Net earnings	13,486,964	13,642,460	—1.1	..	..
Kansas City Power & Light (Year ended Nov. 30)					
Gross earnings	13,675,777	12,305,413	11.2	48	49
Net earnings	6,671,586	6,170,801	8.1	..	..
Penn-Ohio Edison & Subs. (Year ended Nov. 30)					
Gross earnings	26,610,625	25,580,857	4.0	59	64
Net earnings	10,810,956	9,293,670	16.4	..	..
Portland Electric Power (Year ended Nov. 30)					
Gross earnings	12,507,207	12,158,668	2.9	60	60
Net earnings	5,029,053	4,906,544	2.5	..	..
Puget Sound Power & Light & Subs. (Year ended Nov. 30)					
Gross earnings	15,146,340	14,808,793	2.3	56	57
Net earnings	6,626,873	6,308,986	5.0	..	..
Southern California Edison (Year ended Nov. 30)					
Gross earnings	34,825,941	30,487,313	14.0	33	32
Net earnings	23,418,352	20,617,590	14.0	..	..
Tennessee Electric Power (Year ended Nov. 30)					
Gross earnings	13,382,302	12,472,642	7.3	52	54
Net earnings	6,460,122	5,733,958	12.7	..	..
Texas Power & Light (Year ended Oct. 31)					
Gross earnings	9,679,490	9,353,780	3.0	53	55
Net earnings	4,524,410	4,158,789	9.0	..	..
Virginia Electric & Power & Subs. (Year ended Nov. 30)					
Gross earnings	16,155,804	15,440,586	4.6	57	60
Net earnings	6,947,585	6,245,418	11.2	..	..

Business News and Market Conditions

N.E.M.A. Executives Comment on Factors Affecting Industry

Electrical Industry Asset to Nation's Welfare

By Huntington B. Crouse
President National Electrical Manufacturers' Association

If a study of the underlying causes of industry growth is made in this country, it will be found that the electrical industry has made great contributions to national industrial welfare. The many applications of electricity and the usefulness and attractiveness of electrical products have stimulated the growth of the electrical industry in all its branches and have supplied many of the facilities that enable other industries to reach new heights of prosperity during 1928. In addition to these contributions to material welfare the electrical industry has helped to bring about the new standards of living and comfort that exist in this country.

With each passing year comes added proof that we as a nation are becoming electrical-minded.

Assurance that these general standards of service will be permanent and show steady improvement each year is indicated by the enthusiastic co-operation of all branches of the electrical industry in approaching important problems.

Keener Competition Stimulates Electrical Industry

By F. R. Fishback
Vice-President in Charge of Apparatus Division, National Electrical Manufacturers' Association

The keener competition in industry of all kinds during the year 1928 has been of help to the members of the National Electrical Manufacturers' Association and the electrical industry as a whole. The past year has been marked by an increasing necessity among manufacturers to reduce costs and man-power. Due to the flexibility of electrical power, both in the transmission and application of power, the electrical industry has had an important part to play in this year. It can be said, therefore, that the electrical manufacturer has concentrated on the problem of manufacturing automatically.

This year has shown a tendency toward the more efficient use of electricity rather than the mere use of it.

The large units in each specific industry are practically electrified throughout. It will now be necessary for the small units to follow in order to stay in business.

The problem ahead of N.E.M.A. and the electrical industry is therefore one of more intensive education.

In view of the overnight developments in electrical engineering, it is the part of a fortune teller rather than that of an engineer to foretell what 1929 will produce.

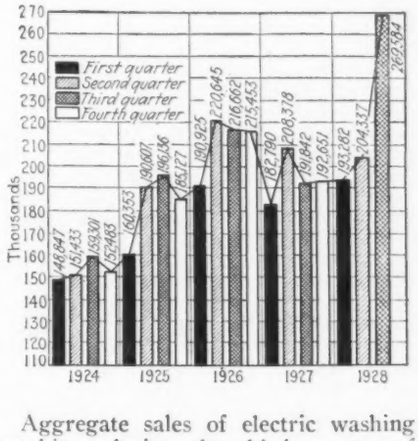
It can be safely stated, however, that the use of electricity is bound to be greatly increased.

Public Interest Paramount in Industry's Policies

By Alfred E. Waller
Managing Director National Electrical Manufacturers' Association

The electrical manufacturing industry will continue during the coming year its intensive study of the technical and commercial problems which concern its development. Co-operative self-government by industry, in the public interest, is the order of the day, and the electrical industry is making unprecedented progress along these lines. A clear and concise statement of the public interest is used as the policy approach to industry problems. It is a primary duty of trade associations to bring every unit of their industry into action on this basis. Gratifying progress has been made during the past year and greater progress is certain in the months to come.

Sales of Washing Machines



Aggregate sales of electric washing machines during the third quarter of 1928 reached the unprecedented total of 269,584, which compares with the second quarter total of 204,337, an increase of almost 33⅓ per cent. This total compares with the previous high of 220,645 for the second quarter of 1926.

According to present indications the year's total will exceed 900,000, which compares with 775,661 for 1927 and 843,645 for 1926.

Incandescent Lamp Sales Exceed Half Billion

Sales of incandescent lamps in the United States during 1928 were approximately 319,000,000 large size and 240,000,000 small lamps, according to a review of the electrical industry for the year by John Liston of the General Electric Company. This is an increase of about 1,500,000 in the large sizes over 1927 and 20,500,000 in the small sizes over the previous year.

"Sales during the past year were the largest in the history of the industry," according to Mr. Liston. "The new type lamps with inside frosted finish, introduced two years ago, have met with marked success. The demand for these new lamps is now about 98 per cent of the total sold.

"Large lamp prices are now 49 per cent and miniature lamp prices are 48 per cent of the corresponding 1914 figures."

Sales of Electrical Merchandise

The following items are included in a summary of the sales of electrical merchandise published by *Electrical Merchandising* in the January issue:

	1927	1928
Heaters and radiators	$2,475,000	$2,430,000
Oil burners (motor-driven mechanical draft only)		64,750,000
Ranges	17,600,000	22,175,000
Refrigerators, domestic	82,125,000	128,700,000
Cookers	1,800,000	1,000,000
Heating appliances	32,963,844	39,598,000

British Electrical Orders Below Estimate

The total capacity of electrical plant placed on order in Great Britain during the first nine months of 1928 was slightly over 400,000 kw., although at least 700,000 kw. was anticipated by the British Electrical and Allied Manufacturers' Association. Industry accounted for almost 35 per cent of this total, owing to certain very large contracts of a special nature. This percentage represented by industry was the highest recorded in any year since the conclusion of the war and is attributable to the greater activity ruling in industry in 1927. Supply undertakings, especially the power companies, have been below normal in the orders they have placed for generating plant. There are indications, however, that rapid improvement will set in in the last quarter of the year.

Market Conditions

NATURALLY the turn of the year brought no radical change in the trend or volume of electrical manufacturing business, but the outlook, according to officials of the leading producers, is for at least as satisfactory a period during the opening months of this year as was the closing quarter of 1928. This quarter was, in many lines, the best on record.

Power company purchases continue to feature business throughout the East, including New England and the Southeast. One order for generators reached a total of $175,000. Inquiries are exceedingly active in these districts.

Central-station business is active also in the Middle West and St. Louis districts, and is supplemented by substantial industrial demand. The railroad business is expected to provide some sizable orders in the near future.

The Pacific Coast area reports a number of large equipment orders from power companies as well as a satisfactory volume from industrial sources. The British Columbia Electric Railway will spend $8,000,000 in the development of power resources this year. The Puget Sound Power & Light Company has a large construction program under way.

Active Buying in Eastern District

Sizable transactions are in progress in the Eastern district for a diversified line of electrical equipment. Inquiries are brisk and a good accumulation of orders seems destined to ensue. Manufacturers are encouraged over the outlook for the first quarter of 1929. A Connecticut power company has contracted for a 40,000-kw. turbo-generator to cost $475,000. A cement company in Texas has ordered a 3,500-kw. unit of the same type from a Pennsylvania maker, while a utility company in the same state has placed a contract with a New York manufacturer for a 25,000-kw. turbo-generator to cost $400,000. A metropolitan power company has given a commitment for transformers and oil circuit breakers for a substation installation to cost $235,000. A municipality in Missouri has purchased a switchboard and auxiliary apparatus for a municipal power plant.

The demand for industrial equipment shows a tendency to be a little quiet, with the exception of motors, which are recording satisfactory sales. Chemical plants, iron and steel mills, cement mills, automobile plants, paper and textile mills are the most active industrial buyers at the present time. The call for fractional-horsepower motors continues active. A manufacturer of washing machines in northern New York has purchased a quantity of such units to an amount of $30,000, while a maker of pumps and compressors in Connecticut has also been an active buyer. An aircraft manufacturer in Connecticut has contracted for a quantity of impellers to cost $40,000.

A manufacturer of high-tension porcelain insulators says that indications point to a record year for equipment of this kind during 1929. A maker of fuses says that there is a fair demand for those of cartridge type, but that plug fuses are very inactive. The call holds excellent for electric elevators in the metropolitan zone; a department store has placed an order with a New York manufacturer for equipment of this kind to cost $75,000. Floodlighting equipment and beacon lamps for airport service are in an expanding market and record sales are expected during the next twelve months. Construction projects are as follows:

The Utah Copper Company, New York, plans the electrification of its copper mining properties at Bingham, Utah, to cost $500,000. Schenectady, N. Y., plans a central fire signal station to cost $45,000. The General Cable Corporation, New York, has purchased property adjoining its plant at Perth Amboy, N. J., and contemplates an addition to cost $350,000. The Eastern New Jersey Power Company, Asbury Park, N. J., plans a call for bids for a proposed steam-operated electric power plant at Sayreville, N. J., to cost $5,000,000. The American Container Company, Philadelphia, plans a plant unit to cost $200,000. The proposed electric steel foundry of the American Foundries Company, Philadelphia, at Eddystone, Pa., referred to last week, will cost $5,000,000, instead of smaller sum, previously noted. The Rex Hiede Rubber Manufacturing Company, East Brady, Pa., will build an addition to cost $70,000. The Pennsylvania Power Company, New Castle, Pa., will built a substation and make extensions in transmission lines to cost $750,000. The Pennsylvania Training School, Morganza, Pa., will receive bids until Jan. 18 for a gas engine-generator set of 250 hp. capacity, with accessories. The National Tube Company, Pittsburgh, plans extensions in its steel tube mills at McKeesport, Pa., and Lorain, Ohio, to cost $15,000,000. The American Window Glass Company, Pittsburgh, plans an expansion in its plant at Arnold, Pa., to cost $3,000,000. The Gulf Refining Company, Pittsburgh, plans a laboratory to cost $100,000. The General Purchasing Officer, Panama Canal, Washington, will receive bids until January 18 for blowers, pressure gages, etc. (Panama Schedule 1930.)

Power Equipment Active in New England

Activity in orders and negotiations marks the trend in the New England district. During the past week an order for three waterwheel generators for a western Massachusetts hydro-electric plant, amounting to more than $175,000, was received by one manufacturing company. Negotiations and inquiries are gaining and much optimism prevails in view of large orders to be placed soon. Industrial equipment orders received include power motors for paper mill use, consisting of several 200 hp. units and accessories and control amounting to $30,000, an order for 5,000 small motors to be used in the manufacture of electrical appliances and numerous small lots of motors ranging up to 50 hp. One manufacturer recorded sales in motors amounting to over $65,000 and another reports an encouraging activity in power control apparatus. Scheduled material is moving well; commercial electric ranges are active and interest in these appliances is increasing. Industrial activity in this district is reported to be gaining more stability; employment conditions are more favorable than a year ago and merchandising prospects are promising.

Volume of Business Good in Southeast

Considerable agitation regarding prospective large commercial and industrial projects but few orders of outstanding size were to be noted in the Southeast, but the general volume of business is satisfactory. One interesting order placed was for $13,300 worth of weatherproof stranded copper, while some other large orders for wire were one for 57,000 lb. of Nos. 2, 6 and 2/0 weatherproof and 40,000 lb. of No. 4 bare copper. One of the larger power companies ordered outdoor switching equipment approximating $10,000, while another company will order electrical equipment amounting to $40,000 for a new substation job. One company's watt-hour meter orders totaled $2,600. Some other central-station orders were for bare stranded copper amounting to $1,960, small disconnect switches totaling $1,616 and $1,600 worth of small transformer equipment. The Georgia Power Company has announced an expansion and improvement budget of $7,000,000 for 1929.

Two textile mills in North Carolina placed orders for motor equipment, the orders approximating $4,000 each. An ore mining plant in Georgia ordered 100 hp. in motors for an addition to its plant. The airport in Birmingham let a contract covering $6,000 worth of field lighting equipment and the city of Atlanta ordered lighting fixtures amounting to $3,000 for school buildings now under construction. Construction projects are as follows:

The Harver Paper Company, Wellsburg, W. Va., plans expansions to cost $80,000. Elkins, W. Va., plans a municipal electric light and power plant. The Tennessee Electric Power Company, Chattanooga, Tenn.,

plans a steel tower transmission line from Nashville to Centerville, Tenn., about 45 miles. The Shelbyville Mills, Inc., Shelbyville, Tenn., plans an addition to cost $100,000. The Piedmont Quarries, Inc., Winston-Salem, N. C., plans extensions to cost $75,000. Walhalla, S. C., plans an ornamental lighting system. The Mississippi Power Company, Gulfport, Miss., plans a power substation at Blue Mountains, Miss., to cost $40,000. Orlando, Fla., plans a power substation in the downtown district, to cost $30,000.

Industrial Buying Active on Pacific Coast

The week's outstanding order on the Pacific Coast covers a 20,000-kw. turbine and a 30,000-sq.ft. condenser, ordered from the Westinghouse Company by the Hawaiian Electric Company to handle the increased urban and plantation load around Honolulu. The order is valued at $500,000 and is to be installed next fall under the direction of Dwight P. Robinson of Philadelphia. Other machinery business covers a 250-kva. General Electric generator for waterwheel drive and a switchboard, valued at $6,000, also for the Hawaiian Islands; two oil well drilling motors valued at $2,500 for the Kern district, and nine power feeder regulators, 36-kva. size, valued at $13,000. Manufacturers report many orders for renewals and spares due to the annual plant overhauling, one order covering $15,000 worth of turbine parts.

A railroad is ordering two carload of glass insulators and much pole line business is expected from railroads within the next few months, also an amount of car and shop wiring material. Miscellaneous business covers carloads of 7-in. 35 ft. poles for Petaluma and Sacramento, 300 treated poles, size 8 in. 45 ft., for Honolulu, and $2,000 worth of 500,000-circ.mil leaded cable for a power company.

Exceptionally large projected building covers a 20-story apartment house for San Francisco valued at $1,500,000; a $4,000,000 cement plant for Torrance, a $1,000,000 tire factory for Los Angeles and the new Pittsburgh glass plant near Los Angeles.

The larger motor and apparatus sales reported in the Puget Sound district include $100,000 worth of woodworking machinery, motors, switchboards, etc., to the McCleary door factory at McCleary, Wash.; $6,000 worth of motors for a mill in Skagit County; a 100-hp. motor and texrope drive for a cement mill at Concrete, Wash.; a 75-hp. motor and several smaller ones for a sawmill in Alaska, and two 15-kw. generators and a half dozen small motors for an Alaskan fish cannery. The Puget Sound Power & Light Company has adopted a budget of approximately $9,000,000 to meet construction requirements for 1929, this sum exceeding last year's budget by $4,000,000. Nearly $5,000,000 of the appropriation will be spent in completion of the Shuffleton steam plant at Renton, near Seattle, while the balance will be distributed through eastern nd central Washington. About $300,000 will be spent in Bellingham for new lines and equipment. The British Columbia Electric Railway Company, Vancouver, B. C., plans an expenditure in excess of $8,000,000 in development of power resources during the year, the major portion at Ruskin, on the Stave River, in construction of a 43,000-hp. hydro-electric plant. A $500,000 wool spinning mill is planned in Portland, Ore., by the Jantzen Knitting Mills, and the Hanify Lumber Company plans the electrification of its mill at Raymond, Wash. Construction projects are as follows:

The General Water Heater Corporation, Los Angeles, plans a plant at Burbank, Calif., to cost $100,000. The Paraffine Companies, Inc., Emeryville, Calif., plans extensions in its roofing paper manufacturing mills to cost $500,000. The Kinner Airplane & Motor Corporation, Glendale, Calif., will establish an aircraft manufacturing plant to cost $70,000. Los Angeles and Salinas, Calif., and Yuma, Ariz., plan ornamental lighting systems. Seattle, Wash., plans a power substation on Third Street, to cost $350,000. The Western Colorado Power Company, Durango, Colo., plans extensions in the 44,000-volt transmission line. Tombstone, Ariz., plans the installation of an engine-generator unit and auxiliary equipment in its municipal power plant.

No Valid Reason for Less Construction in 1929

By L. K. Comstock
Chairman of the Board
L. K. Comstock & Company, Inc.

THE amount of electrical construction contracted for in 1928 was greater than in 1927 by more than 10 per cent. The construction contracted for in 1927 was greater by about 11 per cent than that for 1926, which was the record up to 1926 for all time.

There seems to be no valid reason within sight for any material diminution in the volume for 1929; rather, an increase.

Business on Same Level in St. Louis

General business conditions in the St. Louis district remain as last reported. The sales of stock sizes of apparatus seem to have fallen off slightly, but in the last few days inquiries have been coming in good volume. One of the large pipe line companies has closed a contract for 27 electrically driven line pumps to cost about $300,000. Each pump will have a 400-hp. motor and the order for the motor equipment will be placed in a short time. A 200-kw. alternator was bought by one of the railway companies for $4,000, also a 200-hp. auxiliary motor costing $5,000 for a local power company. A central-station company in the southern part of the district purchased a stoker, the installation to cost $10,000. Construction projects are as follows:

The Missouri Electric Power Company, Mountain Grove, Mo., plans a 145-mile transmission line from Marshfield to Cuba, Mo. The A. P. Green Fire Brick Company, Mexico, Mo., will make extensions to cost $100,000. The Wood Parts Corporation, West Helena, Ark., plans an addition to cost $80,000. The O. K. Ice Cream & Candy Company, Pine Bluff, Ark., plans a factory to cost $100,000. Bryan, Tex., plans additions in its ornamental lighting system. San Antonio, Tex., plans a fire and police signal alarm system with underground conduits. Spur, Tex., plans a municipal electric light and power plant. The Louisiana Public Utility Company, Lafayette, La., plans a power plant and an ice-manufacturing plant at Oakdale, La., to cost $65,000.

Building Outlook Encouraging in Middle West

General business in the Middle West apparently got off to a good start the first week in the new year. The inventory period found most industries with normal stocks on hand and in a generally satisfactory condition. The building outlook is encouraging, considerable highway construction is anticipated and a large amount of railroad material is expected to be placed. Reports of the steel, automotive and agricultural implement manufacturing industries indicate a highly satisfactory condition, while billions of dollars are scheduled for expenditure by the utility companies in their investment programs. Among the interesting orders placed was one for transformer parts valued at $95,000 and one for spare turbine parts valued at $65,000. General commitments are large, one untility company averaging $166,000 per day. Several of the large companies have taken advantage of the low tin market, placing large commitments for solder. Jobbers' sales have been generally good and further improvement is looked for throughout the coming year. Construction projects are as follows:

The LaCrosse Rubber Mills Company, Indian Hill, LaCrosse, Wis., plans additions to cost $100,000. The Wisconsin Valley Power Company, Wausau, Wis., plans a transmission line from Woodruff to Sayner, Wis., also a line between Hazelburst and Lac du Flambeau, Wis. Motor Products Corporation, Detroit, plans four plant units to cost $200,000. The White Star Refining Company, Detroit, plans an oil refinery to cost $200,000. The Burton-Dixie Corporation, Chicago, plans a mattress factory at Lansing, Mich., to cost $225,000. The C. A. Burnette Company, Chicago, plans a cold storage plant to cost $60,000. The Federal Pipe & Supply Company, Chicago, plans a plant unit to cost $300,000. The Van Camp Packing Company, Iidianapolis, Ind., plans an addition to its canning plant at Elwood, Ind., to cost $65,000. The Cleveland Electric Illuminating Company, Cleveland, plans an addition to its Avon, Ohio, power plant and extensions to substations to cost $5,000,000. The Continental Lithograph Corporation, Cleveland, Ohio, plans a factory to cost $125,000. The Crown Overall Manufacturing Company, Cleveland, Ohio, plans a factory addition to cost $200,000. The Estates Stove Company, Hamilton, Ohio, plans an addition to cost $60,000. The Libbey-Owens Sheet Glass Company, Toledo, Ohio, plans a plate glass manufacturing plant and grinding unit to cost

$3,500,000. The Woodville Lime Products Company, Toledo, Ohio, contemplates expansions at its plant at Woodville, Ohio, to cost $600,000. The Penn Ohio Edison Company, Youngstown, Ohio, plans extensions in its power substations and transmission lines to cost $1,000,000. The Central West Public Service Company, Omaha, Neb., will erect a transmission line from the power plant on the White River to Chamberlain, S. D., and vicinity, to cost $200,000. Vermillion, S. D., will receive bids until Jan. 23 for automatic mechanical stokers. Lakefield, Minn., will receive bids until Jan. 16 for a Diesel oil engine-generator set, 300 hp. capacity, for the municipal power plant. Fairmont, Minn., plans an improved street lighting system in the Hazelmere district. The Kohrs Cold Storage Company, Davenport, Iowa, plans an addition. The Chicago, Rock Island & Pacific Railway Company, Chicago, plans an engine house and locomotive repair shops at Des Moines, Iowa, to cost $100,000. The Marshalltown Canning Company, Marshalltown, Iowa, plans a factory to cost $65,000. The Des Moines Electric Light Company, Des Moines, Iowa, plans substation at Valley Junction, Iowa, to cost $35,000.

Demand for Copper Subsides

A featureless week is reported by non-ferrous metal traders. Other than the flurry in copper over the holidays, and a gradual improvement in the lead situation, the situation is unchanged from that prevailing for several weeks. Prices of copper, lead, and zinc are firmly established at 16.75, 6.65 and 6.35 cents per pound respectively. Tin and the other metals are substantially unchanged.

NEW YORK METAL MARKET PRICES

	Jan. 2, 1929 Cents per Pound	Jan. 9, 1929 Cents per Pound
Copper, electrolytic	16.75	16.75
Lead, Am. S. & R. price	6.65	6.65
Antimony	9.67	9.625
Nickel, ingot	35	35
Zinc, spot	6.70	6.70
Tin, Straits	49.875	49.875
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Jan. 9, 1929, 18½ cents.

Activities of the Trade

Electric Auto-Lite Buys Columbus Auto Parts

The Electric Auto-Lite Company has acquired control of the $1,500,000 plant and business of the Columbus Auto Parts Company, Columbus, Ohio, largest manufacturer of automobile tie rods and drag links for steering mechanism, adding another link in the continually widening chain of the electrical company's activities in the automotive field.

The Toledo concern also recently secured a substantial interest in the Eclipse Machine Company of Elmira, N. Y., and besides its big battery subsidiary plants has other interests in automotive manufacture. Last May it acquired the Presto-Lite Company, manufacturer of ignition systems, for $800,000, which at the present rate of operation will pay for itself in two years.

Sales of the concern during 1928 aggregated $38,000,000, President C. O. Miniger says, as compared to $23,000,000 in 1927. Grosses as high as $60,000,000 are predicted for 1929. Some 8,000,000 batteries will be turned out this year, as against 5,000,000 during the past year. More than half the battery requirements of the Ford 1929 production will be supplied by Electric Auto-Lite, which also will supply all the needs of Hudson, Willys-Overland, Nash, Hupp and Durant.

Crane Companies Merge

The Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., and the Niles Crane Corporation, Philadelphia, have been consolidated under the name of the Shepard-Niles Crane & Hoist Corporation. The Shepard plant at Montour Falls, N. Y., and the Niles plant at Philadelphia will continue operation, with the main office at Montour Falls. The officers of the combined company are Frank A. Hatch, president; Sydney Buckley, first vice-president; Robert Turner, vice-president; James Shepard, vice-president, and E. A. Deeds, chairman of the board of directors.

Graybar Electric Sales Reach New High Level

Closing the best quarter in the history of the company from a standpoint of sales volume, the Graybar Electric Company records a year's total of $75,000,000. This is embodied in an announcement by G. E. Cullinan, vice-president in charge of sales. Mr. Cullinan looks forward to a very satisfactory year.

Seven new distributing branches were added to the company during 1928 and further expansion will be carried out as it is warranted, according to Mr. Cullinan. The company acts not only as the sole distributor for many Western electric products in the domestic market but also acts as distributing agency for more than 200 manufacturers whose products vary widely. Graybar sells under its own name and trademark such items as radio receiving sets, washers, ironers, sewing machines, lighting fixtures, fans and vacuum cleaners.

At the first directors' meeting of the reorganized Graybar Electric Company Frank A. Ketcham, formerly executive vice-president, was appointed president, while Albert L. Salt, formerly president, becomes chairman of the board. Announcement was also made of the appointment of Walter J. Drury of New York and Walter P. Hoagland of Chicago, eastern and central district managers, to the board of directors of the company.

The complete list of officers of the company, as announced following the directors' meeting Monday, follows: Albert L. Salt, chairman of the board; Frank A. Ketcham, president; George E. Cullinan, vice-president; Leo M. Dunn, vice-president; Elmer W. Shepard, treasurer, and Louis Fiille, secretary.

Moloney Electric Purchase Incorrectly Reported

The Moloney Electric Company was purchased from the American Brown Boveri Electric Corporation about the middle of 1928, rather than purchased by that corporation, as was inadvertently stated in a recent issue of the ELECTRICAL WORLD. The company is engaged in the manufacture of transformers and has plants in St. Louis and elsewhere.

Cutler-Hammer Reorganization

The incorporation is announced of a new company, Cutler-Hammer, Inc., to acquire the property, business and good will of the Cutler-Hammer Manufacturing Company. Under the reorganization plan the new company will have authorized capital stock of 750,000 shares, of which 275,000 will be issued to shareholders of the old company, share for share, in exchange for their present stock. The plan involves the dissolution of the present company and its two subsidiaries, the Cutler-Hammer Manufacturing Company (of New York) and the Cream City Foundry Company (of Wisconsin). The new stock will be listed on the New York stock exchange.

Standard Gas Appliance Sales

Subsidiary and affiliated companies of the Standard Gas & Electric Company sold $5,883,758 worth of electric and gas appliances during 1928. This is an increase of 11.8 per cent over the corresponding period of 1927. The figure quoted includes jobbing, fixtures and wiring.

Arrow Electric-Hart & Hegeman Merger

Effective at the close of business, Dec. 31, 1928, by an agreement of consolidation, the Arrow Electric Company and the Hart & Hegeman Manufacturing Company, both of Hartford, Conn., have merged and become one corporation under the name of the Arrow-Hart & Hegeman Electric Company.

The new company will have two divisions, the Arrow Electric division

and the Hart & Hegeman division. Commercially these two divisions will operate independently through their own distributing channels. It is believed that this merger will result in new lines, more efficient manufacturing, better service and a better product.

THE TIMKEN ROLLER BEARING COMPANY, Canton, Ohio, announces the appointment of Judd W. Spray as vice-president and general sales manager. Mr. Spray has been general sales manager of the company since 1926 and previous to that he had been sales manager of the automotive division of the company in Detroit for several years.

THE GENERAL ELECTRIC COMPANY, merchandise department, Bridgeport, Conn., has placed on the market a new 10-in. electric fan, superseding the present 9-in. model. This fan is especially suited to the apartment or small home and may be readily adjusted for either desk or bracket use. It is manufactured in both oscillating and non-oscillating models.

THE GRISCOM-RUSSELL COMPANY, 285 Madison Avenue, New York City, manufacturer of power plant steam specialties, announces that its Boston office is now located in the Chamber of Commerce Building, 80 Federal Street.

THE ERIE MALLEABLE IRON COMPANY, Erie, Pa., announces that on January 1 Edgar E. Dawes became district manager of the "Kondu" division for the southeastern section with headquarters at Atlanta, Ga.

THE HISEY-WOLF MACHINE COMPANY, Cincinnati, Ohio, manufacturer of electric drills, grinders and buffers, has recently opened a branch office at 210 Machinery Hall, 549 West Washington Boulevard, Chicago, in charge of Roy D. Haworth.

THE WAGNER ELECTRIC CORPORATION, St. Louis, announces that N. H. Spencer has joined its sales force at Dallas, Texas. Mr. Spencer's experience in the electrical field covers a total of some twenty years and for the past eight years he has been with the Pittsburgh Transformer Company of Pittsburgh.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, manufacturer of electric controlling devices, announces that its New York office has received a contract from the Harland Engineering Company, Toronto, Ont., for the complete electric control equipment, including magnetic brakes and accessories, for the Welland Canal project in Canada.

THE ROCK ISLAND MANUFACTURING COMPANY, Rock Island, Ill., manufacturer of electrical household appliances and hardware specialties, announces the appointment of W. S. Etheridge as general sales manager. Mr. Etheridge has nearly fifteen years of merchandising experience in the electrical field and during the past 3½ years he has been general sales manager of the Hamilton-Beach Manufacturing Company of Racine, Wis., and sales manager of the electrical division of the American Flyer Manufacturing Company, Chicago.

THE EUREKA VACUUM CLEANER COMPANY, INC., Cleveland, announces the appointment of Oliver B. Capelle, formerly sales promotion manager, as publicity manager of its company.

THE ROME WIRE COMPANY, Rome, N. Y., will commence the erection of a new building for the manufacture of "Trenchlay," one of the company's recent products. It will be 200x205½ ft. and will have 41,000 sq.ft. of floor space.

THE RAINBOW LUMINOUS PRODUCTS INC., 120 Broadway, New York City, manufacturer of luminous tube-lighting apparatus, announces that a new operating subsidiary has been formed and three new plants, located in Louisville, Ky., Denver, Colo., and Dallas, Texas, are being established. The new subsidiary, which is located in Louisville, Ky., will handle the production and distribution for its immediate Southern territory and the plants in Denver and Dallas will handle orders from their immediate territories.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has secured a permit for the erection of a new building to be 100 x 602 ft. which will form part of the East Springfield, Mass., works. It will be used for radio production.

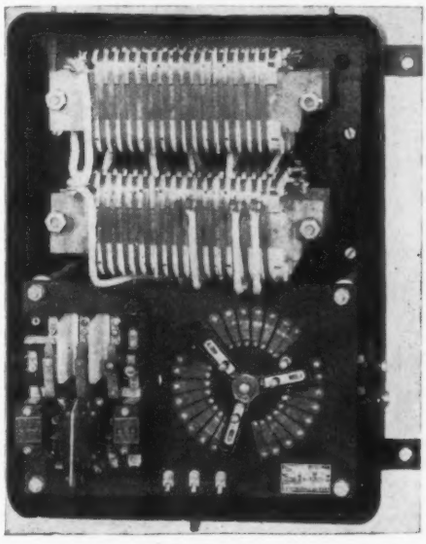
THE JAMES R. KEARNEY CORPORATION, 4224 Clayton Avenue, St. Louis, manufacturer of overhead and underground equipment, announces a new line of equipment called the Kearney hot line tools and accessories.

THE GENERAL REFRACTORIES COMPANY, 104 South Sixteenth Street, Philadelphia, has opened a new district sales office in Boston at Room 509, Marshall Building, 40 Central Street. The office will be in charge of Nelson W. Bowman, formerly of the company's New York office.

New Equipment Available

Speed Controller for Fans and Blowers

The development of a new speed controller for slip-ring induction motors and primarily for the control of motors driving ventilating fans in buildings has



been announced by the General Electric Company. The new device has the primary magnetic switch, dial type controller and speed-regulating resistance mounted in a sheet-steel closing case. The new controller will apply particularly where the amount of torque required decreases as the speed is reduced. The controllers provide overload and under-voltage protection and will give about 50 per cent speed reduction by inserting resistance in the rotor circuit.

The controller consists of a line contactor, a temperature overload relay, a secondary dial switch operated from the outside of the cover, a resistor and "start-stop" push-button station. The inclosing case is ventilated and provided with knockouts in the top and bottom. The push-button station is mounted in the inclosing case with its buttons extending through the right-hand side. Speed regulation is obtained by moving the dial switch arm on the front of the inclosing case. The dial switch and line contactor are not interlocked and consequently the motor will come up to the speed corresponding to the setting of the dial switch. It is thus possible to throw the motor directly on the line with all resistance cut out of the secondary in case the dial switch arm is in full-speed position.

Joint Boxes for Armored Cables

A new low-voltage joint box especially designed for use with steel tape armored cables in airport and airway lighting installations has just been placed upon the market by the Standard Underground Cable Company, division of the General Cable Corporation, Pittsburgh, Pa. The boxes are designed to insure complete electrical and mechanical protection to the cable joint. They are light in weight, occupy a small amount of space and require but a small amount of insulating compound. Cable clamps bind the steel tape armor in place and make rigid mechanical connection between the box and armor, thus relieving the joint of longitudinal stress.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 18, 1928)

1,695,264. ELECTRICAL INDICATING INSTRUMENT; C. M. Adams, Ottawa Hills, Ohio. App. filed Oct. 13, 1926.

1,695,295. TEMPERATURE INDICATOR; E. A. Rollins, Roxbury, Mass. App. filed July 11, 1923.

1,695,302. ELECTRIC HEATER; F. W. Thompson, West Haven, Conn. App. filed April 12, 1922.

1,695,353. ELECTRICAL GENERATING SYSTEM; F. F. Starr, Dayton, Ohio. App. filed Nov. 16, 1925.

1,695,359. MOTOR-CONTROL MECHANISM FOR MACHINE TOOLS; S. W Bath, Worcester, Mass. App. filed Dec. 14, 1925.

1,695,391. SQUIRREL-CAGE WINDING; T. Schou, Mansfield, Ohio. App. filed July 14, 1920.

1,695,413. ELECTRIC-LIGHT FIXTURE; W. P. Crockett, Chicago, Ill. App. filed April 4, 1927.

1,695,422. ELECTRIC METER; G. W. Grisdale and E. Schneider, Chicago, Ill. App. filed Aug. 25, 1924.

1,695,424. WHEATSTONE BRIDGE METER SYSTEM; T. R. Harrison, Philadelphia, Pa. App. filed March 26, 1925.

1,695,484. SELF-STARTING SYNCHRONOUS INDUCTION MOTOR; C. Fayer, Flushing, N. Y. App. filed May 2, 1924.

1,695,488. CIRCUIT-CONTROLLING MEANS; T. R. Harrison, Philadelphia, Pa. App. filed June 4, 1924.

1,695,506. AUTOMATICALLY-RECLOSING CIRCUIT BREAKER; E. C. Raney, Columbus, Ohio. App. filed March 17, 1922.

1,695,518. ELECTRIC LOCK; G. W. Watson, Detroit, Mich. App. filed Oct. 10, 1927.

1,695,535. LIQUID-FUEL-PUMPING APPARATUS; W. C. Carter, Flint, Mich. App. filed Feb. 27, 1925.

1,695,546. THERMOSTATIC CONTROL OF ELECTRIC CIRCUITS AND APPARATUS AND OTHER DEVICES; J. G. Goodhue, Evanston, Ill. App. filed Jan. 15, 1923.

1,695,557. SPARK-PLUG-TESTING DEVICE; R. H. Myers, Hagerstown, Md. App. filed April 16, 1926.

1,695,601. AUTOMATIC STEERING FOR DIRIGIBLE CRAFT; C. B. Mills, Brooklyn, N. Y. App. filed June 19, 1922.

1,695,615. AUTOMATIC STEERING FOR DIRIGIBLE CRAFT; E. A. Sperry, Jr., Brooklyn, N. Y. App. filed April 9, 1923.

1,695,679. TESTING COIL; M. E. Berlowitz, Belleville, N. J. App. filed Jan. 26, 1926.

1,695,694. AUTOMATIC ELECTRIC WELDING APPARATUS; A. M. MacFarland, Pittsburgh, Pa. App. filed May 28, 1924.

1,695,708. CONTACT DEVICE FOR MAGNETOS; E. Bugatti, Molsheim, France. App. filed Jan. 8, 1925.

1,695,719. OSCILLOGRAPH; R. Rüdenberg, Berlin-Grunewald, Germany. App. filed Dec. 1, 1925.

1,695,723 and **1,695,748.** TIME ELEMENT ELECTRORESPONSIVE DEVICE; G. R. Townsend, Schenectady, N. Y. Apps. filed Sept. 14, and Aug. 5, 1925.

1,695,753. ELECTRICAL HEATER; J. M. Baker, Columbus, Ohio. App. filed Jan. 14, 1928.

1,695,778. ELECTRICAL CONDENSER; E. B. Nowosielski, Bloomfield, N. J. App. filed Jan. 2, 1925.

1,695,789. SHORT-CIRCUITING MECHANISM; C. H. Wolff, St. Louis, Mo. App. filed Jan. 16, 1924.

1,695,794. ELECTRIC SAFETY LAMP FOR MINERS; O. Becker, Jr., Barmen, Germany. App. filed April 28, 1927.

1,695,795. PLATING TANK; W. E. Belke, Chicago, Ill. App. filed April 14, 1927.

1,695,801. ELEMENT SUPPORT FOR ELECTRIC STOVES; C. M. Dibble, Joliet, Ill. App. filed Nov. 18, 1926.

1,605,803. ELECTRIC PRESSURE GENERATOR; A. Eimer, New York, N. Y. App. filed May 10, 1924.

1,695,846. LIQUID-LEVEL CONTROL; L. H. Harding, Brooklyn, N. Y. App. filed Sept. 21, 1926.

1,695,847. DETACHABLE ELECTRIC-PLUG FITTING; H. Hertzberg, Brooklyn, N. Y. App. filed Aug. 11, 1926.

1,695,850. PHASE INDICATOR AND METHOD OF DETERMINING THE PHASE RELATION OF ALTERNATING CURRENTS; W. A. Kates, Philadelphia, Pa. App. filed June 17, 1927.

1,695,856. CONTROL SYSTEM; A. A. Ponsonby, Pittsburgh, Pa. App. filed Feb. 21, 1927.

1,695,858. INSULATOR; F. Reiter, Berlin-Charlottenburg, Germany. App. filed Nov. 14, 1925.

1,695,859. SLIP-RING ASSEMBLY WITH SHORT-CIRCUITING CONTACT; H. Richter, Behringersdorf, near Nuremberg, Germany. App. filed Oct. 1, 1926.

1,695,860. ELECTRIC ANNEALING OR HEATING FURNACE; W. Rohn, Hanau-on-the-Main, Germany. App. filed Oct. 23, 1925.

1,695,861. ELECTRICAL MEASURING INSTRUMENT; A. R. Rutter, Forest Hills, and W. G. Mylius, Wilkinsburg, Pa. App. filed Aug. 29, 1927.

1,695,862. SLOT INSULATING CELL; M. Sandfield, Pittsburgh, Pa. App. filed Sept. 16, 1926.

1,695,864. INSTRUMENT-TRANSFORMER MOUNTING; J. Sessinghaus, Berlin-Charlottenburg, Germany. App. filed April 23, 1926.

1,695,865. BRUSH HOLDER; H. C. Specht, Wilkinsburg, Pa. App. filed March 10, 1927.

1,695,866. AUTOMATIC SAFETY SWITCH FOR INDUCTION MOTORS; G. Speiser, Nuremberg, Germany. App. filed Aug. 1, 1925.

1,695,868. DISCONNECTING SWITCH; J. Stolz, Berlin-Charlottenburg, Germany. App. filed Oct. 1, 1925.

1,695,869. HEATING UNIT; E. E. Sutherland and F. F. Forshee, Mansfield, Ohio. App. filed Sept. 9, 1927.

1,695,874. ELECTRIC FURNACE; J. C. Woodson, Mansfield, Ohio. App. filed Sept. 28, 1926.

1,695,878. INDUCTION METER; A. Callsen, Nuremberg, Germany. App. filed May 20, 1926.

1,695,879. THERMOSTATIC DEVICE; E. K. Clark, Mansfield, Ohio. App. filed Dec. 8, 1926.

1,695,884. COLLECTOR RING; D. J. Conant, Pittsburgh, Pa. App. filed March 31, 1927.

1,695,885. PROTECTIVE SYSTEM; L. N. Crichton, Pittsburgh, Pa. App. filed March 18, 1925.

1,695,886. TAP-CHANGER SYSTEM; W. M. Dann and L. H. Hill, Sharon, and E. F. Sipher, Wilkinsburg, Pa. App. filed March 31, 1926.

1,695,889. TRANSFORMER; W. J. Finnen, Sharon, Pa. App. filed March 31, 1926.

1,695,890. MEASURING INSTRUMENT; C. Le G. Fortescue, Pittsburgh, Pa. App. filed March 18, 1925.

1,695,891. CONTROL SYSTEM; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Feb. 5, 1921.

1,695,892. TRANSMISSION-LINE DEVICE; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 23, 1927.

1,695,906. PNEUMATICALLY-OPERATED STATION; R. J. Wensley, Edgewood, Pa. App. filed Oct. 1, 1923.

1,695,908. SUPERVISORY CONTROL SYSTEM; T. U. White, Pittsburgh, Pa. App. filed April 21, 1924.

1,695,917. ELECTRICAL MEASURING INSTRUMENT; F. Conrad, Pittsburgh, Pa. App. filed Dec. 31, 1921.

1,695,946. INDUCTION MOTOR; S. R. Bergman, Nahant, Mass. App. filed Nov. 29, 1924.

1,695,957. SWITCH; H. Gernsback, New York, N. Y. App. filed Oct. 26, 1925.

1,695,958. ELECTRIC SWITCH; B. E. Getchell, Plainville, Conn. App. filed April 23, 1924.

1,695,965. CONTACT MECHANISM FOR TYPEWRITER-KEY PUNCHES; W. W. Lasker and C. A. Mezger, Brooklyn, N. Y. App. filed Feb. 10, 1925.

1,695,989. ELECTROLYTIC CELL; S. T. Woodhull, Winchester, Mass. App. filed June 23, 1926.

1,696,011. ARC-WELDING ELECTRODE; H. R. Pennington, Chicago, Ill. App. filed Sept. 8, 1924.

1,696,023. MERCURY-ARC DEVICE; V. K. Zworykin, Swissvale, Pa. App. filed Nov. 21, 1925.

1,696,078. HEATING APPARATUS; J. DeRuvo, New York, N. Y. App. filed May 21, 1927.

1,696,102. CONTINUOUS-CURRENT DYNAMO-ELECTRIC MACHINE; A. Schmid and A. Stoll, Stuttgart, Germany. App. filed April 5, 1927.

1,696,124. ELECTRICAL CONNECTION AND METHOD OF FORMING THE SAME; A. G. Plimmer, Cleveland, Ohio. App. filed March 3, 1926.

1,696,132. MEASURING INSTRUMENT; W. Wermeille, St.-Aubin, Switzerland. App. filed Sept. 12, 1927.

1,696,146. THERMOSTATICALLY-CONTROLLED HEATING PLUG; E. G. K. Anderson, Evanston, Ill. App. filed April 14, 1927.

1,696,150. ELECTRIC SERVICE INSTALLATION; J. Sachs, Hartford, Conn. App. filed July 28, 1922.

1,696,151. PUSH-BUTTON-SWITCH CONSTRUCTION; F. Staedeli, New York, N. Y. App. filed Oct. 10, 1925.

1,696,169. TRAIN-CONTROL RELAY; R. C. Leake, Rochester, N. Y. App. filed Nov. 3, 1921.

1,696,170. ENGINE RELAY; R. C. Leake, Rochester, N. Y. App. filed Jan. 6, 1922.

1,696,177. SYSTEM OF DISTRIBUTION; E. R. Evans, Great Barrington, Mass. App. filed March 11, 1921.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

New Trade Literature

MOTORS AND TRANSFORMERS. — "Manual of Electrical Testing" is the title of a fourth edition of bulletin No. 138 issued by the Wagner Electric Corporation, St. Louis. The bulletin covers the testing of single-phase and polyphase motors and the testing of transformers for core loss, copper loss, polarity, insulation, temperature rise and efficiency.

ELECTRICAL EQUIPMENT. — Special publication No. 1717-C issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., contains a few of the many engineering achievements of the Westinghouse company for 1928. It contains various illustrations showing installations of some of the company's equipment as examples of the trend of the electrical industry.

RAILWAY CAR EQUIPMENT, ELEVATOR CONTROL AND FUSE QUARTZ. —Bulletin GEA-971 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the General Electric equipment for gas-electric railway cars. The company also is distributing bulletin GEA-985 covering its elevator motors and control and bulletin GEA-848 describing and illustrating its fused quartz.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Berlin, Germany (No. 35,225), for compressor units for electric refrigerators and another (No. 35,237), for compressor units for electric refrigerators.

An agency is desired in Leipzig, Germany (No. 35,226), for compressor units for electric refrigerators.

An agency is desired in Helsingfors, Finland (No. 35,224), for household electrical dishwashing machines.

An agency is designed in Wellington, New Zealand (No. 35,223), for household electric appliances and another (No. 35,222), for electric locomotives, industrial high-voltage line material and equipment, high-voltage testing and metering equipment, laboratory instruments, electric clocks, flood-lighting equipment, railway electrification supplies, and street and industrial lighting fixtures.

An agency is desired in London, England (No. 35,325), for electric advertising novelties.

An agency is desired in Karachi, India (No. 35,307), for batteries, bulbs, flashlight cases, household electric appliances including electric fans and wire and wire supplies.

Purchase and agency are desired in Milan, Italy (No. 35,323), for static condensers for improvement of power factor of electric motors.

An agency is desired in Porto Alegre, Brazil (No. 35,305), for farm-lighting sets and commercial electric refrigerators.

A sole agency is desired in Weltevreden, Java (No. 35,324), for nickel case flashlights with focusing device.

An agency is desired in Hamburg, Germany (No. 35,326), for hotel appliances.

An agency is desired in Vienna, Austria (No. 35,359), for household electric appliances.

Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.